2015 National Cooperative Soil Survey National Conference

June 7-11, 2015
Duluth, Minnesota
z.umn.edu/ncssconference15

Program & Schedule

2015
International
Year of Soils

Program at a Glance

Sunday, June 7, 2015

7:30-8:00 a.m.	Sunday Tour Registration	**Ballroom Lobby**
8:00 a.m.-5:00 p.m.	Optional Tour – tickets required. Buses load on Level One of hotel, Superior Street Entrance.	
1:00-5:00	Conference Registration	**Ballroom Lobby**
5:00-8:00	Welcome Reception	**Lake Erie/Ontario**

Monday, June 8, 2015

7:00 a.m.	Registration and Coffee	**Ballroom Lobby**
8:00	General Session	**Great Lakes Ballroom**
9:30	Break	**Ballroom Lobby**
10:00	General Session	**Great Lakes Ballroom**
11:30	Lunch (on your own)	
12:30 p.m.	Committee Meetings	
	- Interpretations	**Lake Erie**
	- New Technology	**Lyric I**
	- Research Agenda	**Lake Ontario**
	- Soil and Ecosystem Dynamics	**Great Lakes Ballroom**
	- Standards	**Lyric II**
2:00	Break	**Ballroom Lobby**
2:30	Committee Meetings	
	- Interpretations	**Lake Erie**
	- New Technology	**Lyric I**
	- Research Agenda	**Lake Ontario**
	- Soil and Ecosystem Dynamics	**Great Lakes Ballroom**
	- Standards	**Lyric II**
5:00-7:00	Poster Sessions and Social	**Minnesota Room (2nd level)**

Tuesday, June 9, 2015

7:00 a.m.	Coffee	**Ballroom Lobby**
8:00	General Session	**Lake Michigan/Lake Huron**
8:40	Oral Presentations	**Lake Superior**
	Understanding the NCSS Laboratory Data	**Lake Erie**
	Biological Indicators of Soil Quality/Soil Health	**Lake Ontario**
	Getting Past the Politics …	**Lyric I**
	Particulars of Forestland Ecological …	**Lyric II**
9:40	Break	**Ballroom Lobby**
10:10	Oral Presentations	**Lake Superior**
	Integrating the NCS Characterization Database …	**Lake Erie**

	Three Common Problems in Technical Writing	**Lake Ontario**
	A workbook process for integrating climate …	**Lyric I**
	Benefits of spatial data structure, consistency …	**Lyric II**
11:10	Transition	
11:15	Oral Presentations	**Lake Superior**
	Soil Data Access Site	**Lake Erie**
	Soil Science: Using Social Media …	**Lake Ontario**
	Selection of Soil Health Indicators …	**Lyric I**
	Determining HEL Status Using GIS …	**Lyric II**
12:15 p.m.	Lunch (on your own)	
1:15	Oral Presentations	**Lake Superior**
	Summarizing NASIS data using R reports	**Lake Erie**
	Soil Systems	**Lake Ontario**
	Utilizing Spatial Analysis to Apply Hydrogeomorphic …	**Lyric I**
	NCSS Soil Laboratory Data Utility for CEAP …	**Lyric II**
2:15	Transition	
2:30	Oral Presentations	**Lake Superior**
	NASIS – Present and the Future …	**Lake Erie**
	Basic tools for Digital Soil Mapping	**Lake Ontario**
	Introducing ICOMTAX; the International …	**Lyric I**
	The Update of Agriculture Handbook 296	**Lyric II**
3:30	Break	**Ballroom Lobby**
4:00	Oral Presentations	**Lake Superior**
	Mapping with gSSURGO - Review of VALU …	**Lake Erie**
	Using the Knowledge Discoverer Module …	**Lake Ontario**
	The Isee Project – Utilizing gSSURGO to Visualize …	**Lyric I**
	Generating a Continuous Gridded Soil Interpretation …	**Lyric II**
5:00	Poster Session and Social	**Minnesota Room (2nd level)**

Wednesday, June 10, 2015

6:30 a.m. – 8:30 p.m.	Field trip and MAPSS Social Event (boxed lunch and dinner included) – tickets required. Buses load on Level One of hotel, Superior Street Entrance.

Thursday, June 11, 2015

7:00 a.m.	Coffee	**Ballroom Lobby**
8:00	General Session	**Great Lakes Ballroom**
9:30	Break	**Ballroom Lobby**
10:00	General Session	**Great Lakes Ballroom**
10:30	Town Hall Meeting	**Great Lakes Ballroom**
12:00	Awards Luncheon	**Great Lakes Ballroom**
12:40	General Session	**Great Lakes Ballroom**
1:00	NCSS Business Meeting	**Great Lakes Ballroom**
2:00	Adjourn	

Program Schedule

Sunday, June 7

7:30 – 8:00 a.m. **Sunday Tour Registration – Ballroom Lobby**

8:00 a.m. – 5:00 p.m. **Optional Tour (Marcell Experimental Forest and associated SPRUCE site) – tickets required**
Buses will load on Level One of the hotel, at the Superior Street Entrance.

Lake Erie/Ontario
5:00 – 8:00 p.m. **Welcome Reception**

Monday, June 8

Ballroom Lobby
7:00 – 8:00 a.m. **Registration and Coffee**

Moderator: *John Beck*, State Soil Scientist, St Paul, MN, USDA-NRCS

Great Lakes Ballroom

8:00 – 8:20 **Welcome from the MN State Conservationist and UMN Chair**
Cathee Pullman, State Conservationist, St. Paul, MN, USDA-NRCS and *Carl Rosen,* Professor and Department Head, Department of Soil, Water, and Climate, University of Minnesota, St. Paul

8:20 – 8:45 **Remarks from NRCS Leadership**
Leonard Jordan, Associate Chief for Conservation, NRCS, Washington, DC

8:45 – 8:55 **Remarks from NRCS Leadership**
David Smith, Deputy Chief, Soil Science and Resource Assistant, NRCS, Washington, DC

8:55 – 9:15 **Soils and a Changing Climate: Soil Science Division Priorities**
Luis Hernandez, Acting Soil Science Division Director, NRCS, Washington, DC

9:15 – 9:30 **Linking Ecological Sites, Dynamic Soil Properties, Conservation Planning and Soil Health**
Skye Wills, Dave Hoover, and *Joel Brown*, USDA NRCS National Soil Survey Center

Intensively managed (agronomic) systems, have a homogenizing effect because high inputs (e.g. energy, fertilizer, irrigation water) can confound the relationships normally used as the basis for ecological site groupings. In these situations, ecological site concepts can be differentiated based upon the ranges of soil function (indicated by dynamic soil properties) that occur as a result of the management (disturbance). In order to use these functional differences and bring insight to management decisions, landscapes dominated by intensive management systems (Cropland in the U.S. Corn Belt), groupings and interpretations using an ecological site framework can serve as a useful tool for soil resource management and assessment. Rather than utilizing state and transition models to reflect the vegetation dynamics and ecological drivers, intensively managed systems require an organization that is based on management techniques and inputs. Such organizational frameworks should provide information about both reference conditions and alternative management options for soil functions or dynamic soil properties within an ecological site. Reference conditions might reflect either native or naturalized vegetation or the highest possible function that an ecological site could support. The organization structure should also include information about expected soil functions or dynamic soil properties under

various types of crops and management systems that might be used. Once established, such a structure will allow for assessments of soil health and function for individual sites, fields and management systems.

Ballroom Lobby

9:30 – 10:00 a.m. **Break**

Great Lakes Ballroom

10:00 – 10:15 **Machine Learning Tools for Classification of Soils Using Microbial Profiles**
Natalie Damaso and *DeEtta Mills*, Florida International University

A vast array of information, both abiotic and biotic, is associated with soils. The current ecological hypothesis is that soil type (i.e., chemical/physical properties) is correlated to the community of microbes that inhabit any particular soil type. Therefore, soil metagenomic profiling should produce a distinguishable biotic profile from a specific soil type from a particular geographic location. In this study, DNA markers from four taxa--bacteria, archaea, fungi, and plant--were amplified using LH-PCR and unique profiles were obtained for 1269 soil samples, spanning six soil types across Miami-Dade County, Florida. Both abiotic parameters obtained from the USDA-NRCS website and subplot level field abiotic data were collected to find patterns within the abiotic and biotic data. Machine learning tools were employed for soil classification based on soil type, transects, and seasons (wet or dry). Five supervised machine learning tool in R programming language (Decision Trees, Random Forests, Neural Networks, Support Vector Machines, and K-Nearest Neighbor) were compared for accuracy of classification using abiotic and biotic data. Our results indicate that all of these tools, with Random Forests having the highest accuracy, were able to classify soils at the level of soil type, transect, and season. These tools will greatly assist in our understanding of the pattern of the structural composition of the microbial community to the abiotic parameters. Moreover, this can lead to a better understanding on the effect of environmental perturbation (abiotic alterations) due to climate change on the soil biota.

10:15 – 11:00 **Climate Change**
Dr. Mark Seeley, Department of Soil, Water, and Climate, Extension Climatologist, University of Minnesota

11:00 – 11:15 **New Tools for Pedologists – Digital Soil Morphometrics**
Alfred Hartemink and *Budiman Minasny*, University of Wisconsin – Madison

Considerable progress has been made in digital soil mapping and the timely collection of new soil data and information. There is an increased demand for soil information by a range of users that drives many of the new soil projects. Here we will describe some ideas and practices for soil profile analysis. It includes (i) tools and techniques for soil profile observations, (ii) continuous depth functions of soil properties, and (iii) mapping of the soil profile. These three aspects are termed digital soil morphometrics and offer potential for enhance our understanding of soils, their distribution across the landscape, and their genesis and classification. Proximal soil sensors and other tools are used that measure in situ a range of soil properties including standard attributes of a soil profile. The sensor may accumulate high spatial resolution data and information more rapidly compared to traditional methods of analysis. Measurements can be made in a soil pit at very small depth intervals. In other cases the measurement is conducted in the lab and gives intervals in the micron range or few centimetres and the increment is much smaller than the depth of soil horizons. It has the potential to create continuous depth functions of soil properties based on measurements rather than interpolations. It also has the potential to map the soil profile and more precisely investigate horizon boundaries.

11:15 – 11:30 a.m. **Discussion and Questions**

11:30 – 12:30 p.m. **Lunch (on your own)**

12:30 – 2:00 p.m. **Committee Meetings**

Interpretations **Lake Erie**

12:30 Opening and Objectives (*Maxine Levin, Bob Dobos*)

12:40 Review of Regional and National Reports (*Bob Dobos*)

1:00 Facilitated discussion of National Interpretation Needs (Agriculture, Range & Forestry Related) (*Bob Dobos, Amir Hass, and Martin Rabenhorst*)

New Technology **Lyric I**

12:30 Opening and Objectives (*Dave Hoover*)
12:40 NEON Sites and Activities (*Jon Hempel*)
1:00 Climate Hubs, SCAN Network, National Soil Moisture Network, SMAP (*Dave Hoover*)
1:15 **Software (R, ArcSIE, TEUI, Envi, Open Source)** (*Robert Vaughn*)
1:30 Soil Map Disaggregation (*Tom D'Avello*)

Research Agenda **Lake Ontario**

12:30 Opening and Objectives (*Doug Wysocki*)
12:40 Overview of 2014 Regional Research Needs Committees
1:00 SSD RFI Research Proposals
1:20 Future NCSS Research Focus and Needs
1:40 Open Discussion

Soil and Ecosystem Dynamics **Great Lakes Ballroom**

12:30 Welcome and Introductions (*Skye Wills*)
12:40 Overview of Committee Purpose (*Patrick Drohan*)
12:50 Updates:
- ES and DSP Within the NCSS (*Skye Wills*) (10 minutes)
- Update on Dynamic Soil Property Activities in SSD (*Skye Wills*)
- Update on Ecological Site Activities in SSD (*Joel Brown*)

1:30 Discussion
- Distribute Charges from Regional Meetings for Later Discussion

Standards **Lyric II**

12:30 Opening and Introduction of Proposed Additions/Changes to Soil Taxonomy (*Monger*)
12:45 Review Recommendations on Proposal #1: Revise Soil Taxonomy For Subaqueous Soils
1:15 Review Recommendations on Proposal #2: Carbonate-Rich Histosols Proposed Changes to Soil Taxonomy

Ballroom Lobby

2:00 – 2:30 p.m. **Break**

2:30 – 4:30 **Committee Meetings**

Interpretations **Lake Erie**

2:30 Ag Handbook 296 MLRA Revision Timeline & General Discussion (*Susan Southard*)
2:45 Continued Facilitated Discussion of National Interpretation Needs (*Bob Dobos*)
3:15 General Discussion (*Maxine Levin*)
4:00 Development of Report to General Assembly (*Bob Dobos and Maxine Levin*)

New Technology **Lyric I**

2:30 Completion of a Soils Layer (Not SSURGO) for All Unmapped Western Lands (*Nate Chaney*)
2:45 Wiki Page for Technology Transfer (Hardware, Software, Training, Processes) (*Dylan Beaudette*)
3:15 General Discussion (*Larissa Ford*)

4:00 Development of Report to General Assembly (*B.J. Shoup*)

Research Agenda **Lake Ontario**

2:30 Open Discussion

Soil and Ecosystem Dynamics **Great Lakes Ballroom**

2:30 Scientific Basis for Using Ecological Sites as a Part of Soil Science
3:00 Alternative Views for the Use and Development of Ecological Sites
3:30 Review and Discussion (Regional Charges)
4:00 Development of Charges and Action Items

Standards **Lyric II**

2:30 Review Recommendations on Proposal #3: Proposed Amendment to Definition of Episaturation to Include Densic Materials
3:00 Review Recommendation on Proposal #4: Proposed Revision to the Criteria for Aquic Hapludults
3:30 Review Any New Proposals Brought to Committee
4:00 Discuss ICOMTAX Steps and Membership

Minnesota Room
5:00 – 7:00 **Poster Sessions and Social**

Tuesday, June 9

Ballroom Lobby
7:00 – 8:00 a.m. **Coffee**

Moderator: *David Hoover*, National Leader, Soil Business Systems, Lincoln, NE, USDA-NRCS

Lake Michigan/Lake Huron
8:00 – 8:20 **Keynote Address on USDA Climate Hubs**
Dr. Jerry Hatfield, National Laboratory for Agriculture and the Environment

8:20 – 8:30 **Logistics for the Day**

Oral Presentations
10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior
8:40 – 8:50 a.m. **The Boundary Waters Canoe Area (BWCA) Wilderness Digital Soil Mapping Project**
Tom D'Avello, *Roger Risley, Suzann Kienast-Brown*, and *Zamir Libohova*, USDA-NRCS

The Boundary Waters Canoe Area resides in the Superior National Forest in Northern Minnesota. The area is approximately 1.1 million acres in size, and forms a border between Minnesota and Canada. The landscape is a complex mosaic of four soil parent materials; namely Rainy Lobe Till, lacustrine Agassiz sediments, outwash deposits and organic deposits. Soil drainage classes range from well-drained to ponded, and soil depth classes range from bedrock exposures to very deep deposits. Entrance to most of the project area is restricted to foot and paddle access only. A project to apply digital soil mapping techniques to map the soils of the BWCA began in late 2012. Training data was collected during the 2013 field season. Several digital soil mapping techniques were employed and evaluated to create raster-based soil class maps including; unsupervised and supervised classification, knowledge-based, classification and regression trees, logistic regression, random forests, and expert, heads-up digitizing. Eleven soil classes

were mapped using these approaches. Validation points were collected in the field during the summer of 2014 for an accuracy assessment, and to instruct the possibilities for post-processing and delivery of the final raster product. Accuracies are in the process of being evaluated with preliminary results indicating overall accuracies (and khat) of 0.71 (0.67) to 0.53 (0.48) depending on the input parameters.

8:50 – 9:00 a.m. **A Hierarchical Approach to Disaggregate Soil Surveys**

Sakthi Subburayalu, Brian Slater, and *Anne Vascik*, The Ohio State University, School of Environment and Natural Resources

The next iteration of soil survey in the National Cooperative Soil Survey of the US includes the disaggregation of soil map units to map soils at the finest soil taxonomic level (soil series). Digital soil mapping (DSM) techniques provide an opportunity to enhance maps and to provide finer resolution soil spatial information. In our study we have taken a hierarchical approach to mapping all 484 soil series in Ohio using DSM techniques. High-resolution environmental correlates including terrain derivatives from LIDAR digital elevation models, climate surfaces, natural vegetation and geologic surfaces have been developed for predictive mapping. In the spatial hierarchy, broader physiographic Soil Regions (Soil Landscape Systems) of Ohio are mapped using Object Oriented Image Processing of selected environmental correlates that are operating at this scale. These Systems are treated as aggregations of fundamental catenas (associations of geographically related series). Once the broader physiographic regions are mapped, the remapping of catenas within each region is achieved by predictive modeling using decision trees and the environmental correlates relevant at the finer scale. The soil series within each catena will be mapped separately to more accurately disaggregate the soil map units. The predicted soil series will be validated against ground-truth soil series information, and spatially explicit uncertainty estimates for the generated soil maps will be generated.

9:00 – 9:10 **Digital Soil Disaggregation in a Low-Relief Landscape to Support Wetland Restoration Decisions**

Maggie Goldman and *Brian Needelman*, University of Maryland

On the Delmarva Peninsula, which includes the Eastern Shore of Maryland and Virginia and most of Delaware, there is pressing need for more spatially detailed soils maps to support the assessment of wetland ecosystem services at a landscape scale and enhance the implementation of wetland conservation and restoration practices. With the availabilty of high resolution LiDAR for the entire Delmarva, finer scale depiction of soils on low relief landscapes of the region may be possible. Using local knowledge of the soil landscape, LiDAR, color infrared aerial photography, and other geospatial data we have developed a method to digitally disaggregate SSURGO soils data with the aim of improving our ability to identify hydric soils on depressional wetland landscapes within the Choptank River Watershed. Preliminary results indicate that stochastic depression analysis is useful for mapping depressions, and the depression surface, catchment area, and relative elevation metrics are important predictor variables of soil types in these landscapes. Strengths and limitations of the methodology will be discussed.

9:10 – 9:20 **Hydric Soils Collaborative Project - Guidance on Problematic Red Parent Materials (PRPM)**

Martin Rabenhorst and *Sara Mack*, University of Maryland College Park; *Jacob Berkowitz*, US Army Corps of Engineers; *Doug Wysocki*, USDA-NRCS

Hydric soils affiliated with certain red parent materials are known to be problematic by failing to demonstrate typical morphological features of hydric soils. Field indicator F21 - Red Parent Material (modified from the original TF2 indicator) has been developed to help address this problem, and in many cases the F21 indicator is the only useful hydric soil indicator available. However, the F21 indicator should only be invoked where soil parent materials are known to have an inherent resistance to developing hydric soil redox features (which can be demonstrated by the Color Change Propensity Index - CCPI). To date, the PRPM has been documented in a limited number of localities, but is thought to be widespread. The Univ. of MD is leading a collaborative project involving the US ACOE and USDA-NRCS field scientists, the Kellogg SS Lab and private sector soil scientists, to document soils, parent materials and geological formations that meet the CCPI for PRPMs, and to provide guidance for field scientists and practitioners regarding the appropriate use of PRPM indicators. This presentation will explain the scientific foundations and principles, goals, strategies and benefits of the effort and is intended to solicit participation in the project.

9:20 – 9:30 a.m. **Sediment Source Tracking in Mid-West Agricultural Basin 30 Years after Implementation of Conservation Resource Management**
Tanja Williamson, USGS

Soil-health management of agricultural lands is associated with several benefits, including improved decreased sediment and nutrient loss and resilience to drought and forecasted climate change. Retirement of agricultural land along drainage ditches is a supported conservation program because of expected water quality improvements. In practice, though, land retirement easements are discontinuous along the channel, with varying widths and ages of retirement, complicating quantification of land retirement effects on the sources of sediment and nutrients in the channel. Channel-bed and suspended sediment were sampled at eight locations, ranging in retired-land distributions and ages, to identify and quantify sediment sources for tributaries of West Fork Beaver Creek, MN. Sediment sources – cropland, retired land, streambank, and roads - were identified using a linear discriminant analysis and four-source mixing model. Retired land contributed to channel-bed sediment but was not discernible as a source of suspended sediment, suggesting that retired land material moved to the channel during relatively dry conditions, including sediment mobilized by freeze-thaw and dry-ravel erosion. Along agricultural ditches with retired land, there was a lower proportion of suspended sediment from cropland relative to the control site that had almost no riparian land in retirement. Cropland sediments had the highest phosphorous concentrations; channels with the highest proportion of sediment from cropland also had the highest phosphorus sediment concentrations.

9:30 – 9:40 a.m. **Open Discussion**

Training Sessions
60 Minutes Each

Lake Erie
8:40 – 9:40 **Understanding the National Cooperative Soil Survey Laboratory Data**
Moderator: *Patty Burns*, MLRA SS, Bemidji, MN, USDA-NRCS
Richard Nesser, USDA-NRCS

The Kellogg Soil Survey Laboratory developed a soil characterization laboratory database to house data produced by USDA soil testing laboratories over a sixty-year period. During the last several years, soil characterization data from 21 cooperating universities has been added to this database. In the year 2000, the Kellogg Soil Survey Laboratory published a web site that provided a way for the public to be able to choose and download this data in a printable report form and a comma-separated-value form. Since that time, more products from the database have been developed that are accessible by the web site. Also, a linkage has been developed between the National Soil Information System (NASIS) database so that data may be integrated to and from the laboratory database, providing more accurate and consistent site location and pedon taxonomy. This training session is designed to familiarize participants with the premises used in the design of the database, how those premises are reflected in the database products, how those database products may be attained, how the participants may become involved in submitting data to the database, and to solicit any ideas for database products that would be useful.

Lake Ontario
8:40 – 9:40 **Biological Indicators of Soil Quality/Soil Health**
Moderator: *Mike Walczynski,* ARSS, Duluth, MN, USDA-NRCS
Faustin Iyamuremye, National Soil Survey Center

Similar to physical and chemical indicators, biological indicators are dynamic soil properties that can be used to assess soil quality/soil health. Because soil quality/soil health cannot be measured directly, biological indicators and other indicators are used as measurable surrogates of soil functions, which are a reflection of soil quality/soil health; concomitantly, indicators are correlated to soil quality/soil health. The soil functions are sustaining biodiversity, storing and cycling nutrients, water partitioning, filtering and buffering, and providing physical stability and support. Compared with physical and chemical indicators,

biological indicators respond quicker to changes occurring in the soil long before they become irreversible to remediate and the soil permanently loses its resilience. Most of those changes are due to management or natural calamities, such as drought, fire, flood, drought, and pollutants. Few biological properties, such as earthworm populations and soil respiration, are measured in the field; most are measured in laboratory conditions, which limits their utilization by field staff. This presentation gives an overview of some selected biological indicators, including soil respiration, soil enzymes, phospholipid fatty acids, particulate organic matter, and potentially mineralizable nitrogen. Recently, there has been a growing interest in soil DNA as an indicator of biodiversity because DNA profiling avoids the problems associated with microbial isolation and culturing techniques used to assess microbial diversity. In conclusion, biological indicators are suitable for assessing soil quality, and particularly soil health, because of their early and fast response to change and their direct or indirect relationship with soil organisms, which affect several soil properties, particularly physical properties (e.g., soil structure).

Lyric I

8:40 – 9:40 a.m. **Getting Past the Politics—Discussing Strategies for Climate Change Adaptation and Improved Soil Health**

Moderator: *Mike Rokus*, MLRA SS, Duluth, MN, USDA-NRSC
Clay Pope and *Sarah Pope,* CSP, LLC-USDA Southern Plains Climate Hub

U.S. agriculture is facing significant challenges created by changing climate and the natural resource issues this phenomenon is exacerbating. Unfortunately, climate change has become a "third rail issue" for many rural Americans. This severely compromises the ability of representatives from state and federal agencies, land grant Universities and other agricultural organizations to discuss strategies designed to help agriculture adapt to the changing climate, strategies which will also mitigate the rate of change. This is especially tragic given that these strategies more often than not involve the same set of practices required to improve the health of the soil. In this training session we will present successful approaches to help professionals discuss the issue of changing climate with agricultural producers in a manner that will result in increased openness to undertaking practices on the land that will help them adapt to changing climate, while also reducing greenhouse gas emissions. Many of these approaches were utilized in the sign-up of producers for Oklahoma's Carbon Program, an effort that resulted in over 50,000 acres being enrolled in what was then the nation's only state-level carbon sequestration program. These practices are also used by the Oklahoma non-point source water quality program, resulting in nearly 50 streams being removed from Oklahoma's 303(d) list of impaired waters.
Those attending the presentation will leave with an approach for discussing the issues surrounding changing climate with producers in a manner that will encourage them to take action on their land.

Lyric II

8:40 – 9:40 **Particulars of Forestland Ecological Site Descriptions**

Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS
Craig Busskohl, NRCS NSSC

Until relatively recently, forested areas have not been a priority for development of ecological site concepts and descriptions with rangeland being the focus. The FOCUS of this session will be on the vegetative component as this seems to be the most vexing for many forested areas. Much of the forested area of the US, especially in the East, are considerably changed from native communities, compounding the difficulty in correlating to physical attributes. A variety of vegetative classification systems are found in different parts of the country. Various levels of vegetative classifications are found in the National Vegetative Classification system- we will examine which level is appropriate if detailed vegetative typing/data is not available for a site. Further, potential vegetative communities are subject to changes due to climate change, dynamic soil properties and invasive plant species pressures. Understanding and describing the dynamics of natural systems is the key to the use and management portions of forest ESDs.

Ballroom Lobby

9:40 – 10:10 **Break**

Oral Presentations

10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior

10:10 – 10:20 **Measuring Sequestered Carbon Contents of Grassland and Forest Soil Profiles in the Neon Initiative**

Geoffrey Davies and *Elham A. Ghabbour*, Northeastern University

The National Soil Project (NSP) has been measuring the total and sequestered OM contents of soil horizons from all fifty US States since 2008 [1]. The data establish a baseline sequestered OM content of a soil and represent its quality and health. This NEON/NSP collaboration reports the total and sequestered OM contents of 11 grassland and forest profiles in 11 US States at elevations of 25 to 1548 m and nine soil orders to depths of 160-200 cm. Such soils are standards against which conventional and organic farm soils can be compared. Total OM is measured by ignition of dried soil samples at 650 oC for 12 hr [2]. Humic acid (HA) is measured gravimetrically [1]; fulvic acid (FA) and sequestered DOC are measured spectrophometrically [3]. Major findings are: 1) the data are mostly reproducible; 2) sequestration drops sharply below the A horizon; 3) spodosol (E) horizons exist in 8 profiles; 4) regression of FA against HA in the Harvard Forest profile has a slope of 0.38 (cf. 0.29 for Maine profiles [2]); 5) average ~ 40%C in supernatants and decreasing FA/HA with depth suggest that FA are precursors of HA. NSP thanks the VK Rasmussen Foundation and the Farmers Advocating for Organics Fund for financial support. The NEON initiative is supported by a grant from the National Science Foundation.

10:20 – 10:30 a.m. **RaCA Traceable Uncertainty Propagation: VNIR vs. Elemental Analysis for SOC Concentration**

Terry Loecke, University of Nebraska-Lincoln; *Skye Wills,* USDA NRCS National Soil Survey Center; *Yefung Ge*, University of Nebraska-Lincoln

The Rapid Carbon Assessment project aims to develop a statistically defendable soil organic C (SOC) stock for the contiguous US (CONUS). To meet this aim reproducible uncertainty estimates are required across spatial scales of inference and sampling design. For the RaCA project, uncertainty propagation is made challenging due to multiple sources of measurement and model precisions. SOC concentration for horizons of the RaCA samples are both modeled from vision-near infrared (VNIR) spectroscopy (rapid approach) and elemental analysis (traditional approach). We will discuss our experiences quantifying uncertainty in the RaCA with different proportions of rapid and traditional approaches of measuring SOC.

10:30 – 10:40 **Mapping and Modeling Soil Organic Carbon in the Eastern Allegheny Plateau and Mountains Using Legacy Data**

James Thompson, West Virginia University; *Katey Yoast*, USDA-NRCS

Because soil contains approximately three times more carbon than the atmosphere, small changes in soil organic carbon (SOC) content can have great impacts on the global carbon budget. In order to understand, predict, and manage these impacts, an initial assessment of SOC stock is needed. Due to its unique and diverse vegetative, climatic, and pedogenic properties, Major Land Resource Area 127 (MLRA 127) was chosen as the study area for creating a methodological framework for predicting SOC stock from Kellogg Soil Survey Lab (KSSL) pedons and environmental covariates. Random forest was used to populate missing bulk density and SOC data from KSSL pedons. SOC stocks were calculated from the prepared KSSL pedons and used to train a geographically weighted regression (GWR) model. The residuals of the GWR model were interpolated using ordinary kriging and added to the GWR model to produce a geographically weighted regression kriging (GWRK) model. The GWR and GWRK models were validated using an independent dataset and uncertainty was assessed using the fuzzy k-means with extragrades approach. It was found that the GWRK model captured more variability than the GWR model and predicted higher SOC stock than current Natural Resources Conservation Service (NRCS) databases. Total terrestrial biosphere carbon calculated using the Forest Inventory Analysis model with SOC represented by the GWRK model revealed that soils in MLRA 127 contain 79% of the total carbon in the terrestrial biosphere. The

methodology framework presented in this research is recommended to the NRCS as a guideline for future DSM studies.

10:40 – 10:50 **Arsenic Content and Geochemistry of Midcontinent Carbonate-Rich Fens: Source or Sink?**
Doug Wysoci, National Soil Survey Center; *Lance Howe* and *Moustafa Elrashidi*, NRCS Redfield, SD; *Michael Whited*, NRCS, St. Paul, MN

In SD, a late Wisconsin (Des Moines Lobe) moraine sequence provides the hydrology and geochemistry that drive two dominant soil-forming processes in fens - organic matter accumulation (Histosols) and mineral precipitation. Key mineral precipitates are CaCO3 and Fe/Mn-oxides. Trace metals co-precipitate with or are adsorbed to Ca, Fe, Mn, Si, and OM. Arsenic, due to its human health risk, is a specific concern. We sampled nine organic-rich fen soils by horizon (76) to two meters or more. Total As content of fen soils ranges from 1 to 2000 mg kg-1. The geometric mean As content is 90 mg kg-1 and the median is 74 mg kg-1. Arsenic levels exceed the present EPA baseline (20 mg kg-1) at all fens sampled. Arsenic content is strongly correlated to DCB extractable Fe, total Fe, and total P. Arsenic content is poorly or negatively correlated to CaCO3, OM, CEC, and total Ca or Mn. Dithionite extractable Fe content ranges from < 1 to 22.5% with a geometric mean of 1.4%. The measured As levels and empirically derived As sorption capacities indicate that ferrihydrite controls both quantity and release of As in these soils. Water samples from surface discharge and runoff points show only trace amounts of As and Fe. Fen soils serve as a natural arsenic sink. Water source, (surface runoff vs groundwater), discharge quantity, and flow path distance, influence the eH/pH conditions that determine ferrihydrite precipitation, dissolution, and transformation (goethite), which in turn influences As and P sorption or release in fens.

10:50 – 11:00 **The Land Suitability Rating System**
Pierre-Yves Gasser, Agriculture and Agri-Food Canada

The Land Suitability Rating System (LSRS) is a spatial modeling tool that generates a class rating for individual parcels of land for specific agricultural field crops based on a soil-climate-landscape potential. LSRS draws information from the Canadian Soil Information Service (CANSIS) soil name and layer tables, a crop parameter table and monthly normal temperature and precipitation values to generate a land rating where class 1 is fully suitable and class 7 in unsuitable. The system has traditionally been used to evaluate land suitability for specific crops under current climate conditions. However, with climate change scenario data readily available for much of the country, we tested a method to use the model to predict future changes in land suitability. A large number of projections of future climate are available that reflect multiple greenhouse gas emissions scenarios and multiple climate model outputs. To evaluate the sensitivity of LSRS to varying climate inputs, we used a subset of six projections giving a range of cold to hot and wet to dry scenarios covering the time periods 2010-2039, 2040-2069 and 2070-2099. As a case study, we applied the LSRS module for corn suitability to the agricultural portion of the lower Fraser Valley of British Columbia. To obtain satisfactory spatial results we linked high resolution (400 m grid) monthly temperature and precipitation values to the individual polygons of a detailed (1:20,000 scale) soil map available for the study area. Soils were ranked by texture and taxonomic groupings in their susceptibility to changing climate conditions. The total hectares of ranked soils were tallied and mapped. The Land Suitability Rating System effectively integrated multiple soil, climate and landscape factors to illustrate that land suitability will be affected by both temperature and precipitation changes with a general trend toward increasing requirement for irrigation in order to maintain corn production in the coming century.

11:00 – 11:10 a.m. **Open Discussion**

Lake Erie

10:10 – 11:10 **Integrating the National Cooperative Soil Characterization Database with the National Information Management System (NASIS)**

Moderator: *Patty Burns*, MLRA SS, Bemidji, MN, USDA-NRCS
Henry Ferguson, NRCS - NSSC

The Kellogg Lab has maintained a laboratory database that contains data for more than 63,000 sites with corresponding descriptions in another database called NASIS or the National Information Management System. The duplication of some of the morphological data in the two databases has sometimes been a source of confusion. More recently data mining reports have been developed to help glean the most current classifications and any updates to locations from NASIS for sites and pedons which have been sampled. Periodically the results of these reports are used to update the products delivered via a website to external customers. A subset of the National Cooperative Soil Characterization Database has been placed in the NASIS database to make it more accessible to individuals maintaining the National Cooperative Soil Survey Data. There are 84 data elements in a NCSS Lab Layer table, and there is a url link from the corresponding NCSS Lab Pedon table that generates reports from both the NCSS Soil Characterization Database and NASIS, which can be used for quality assurance and quality control purposes. This training session is designed to familiarize participants with the latest changes in the NASIS and the NCSS Characterization Database.

Lake Ontario

10:10 – 11:10 a.m. **Three Common Problems in Technical Writing**

Moderator: *Mike Walczynski*, ARSS, Duluth, MN, USDA-NRCS
Aaron Achen, USDA–NRCS National Soil Survey Center

This training session is intended to help authors of technical materials, such as ecological site descriptions, soil surveys, lab reports, and research papers. The participants will be shown how to spot and correct three common, significant errors in sentence construction. The presentation is not specifically about making sentences grammatically correct. It is about removing potential sources of misunderstanding. Writers at all skill levels are likely to benefit. Writing is a complex skill. Due to time constraints, this session focuses on three subtle, high-impact errors. Each of these errors is routinely found in a wide variety of technical documents, is typically difficult for the author to catch, is substantially damaging to the clarity of the writing, and is easily correctable.

Lyric I

10:10 – 11:10 **A Workbook Process for Integrating Climate Change into Agriculture**

Moderator: *Mike Rokus*, MLRA SS, Duluth, MN, USDA-NRSC
Danielle Shannon, Northern Institute of Applied Climate Science (NIACS)

Producers will face challenges developing and implementing conservation and management actions that help managed lands respond to climate change. Cropping, livestock, and forest systems are sensitive to variations in weather and climate including temperature extremes, excess or deficient precipitation, severe storms, and wind. The USDA Midwest and Northeast Regional Climate Hubs and the Northern Forests Sub Hub are working across a range of crops, forests, and livestock production systems to assemble the available information into tools and practices which can increase the resilience of these systems to climate change. In the agricultural sector, the foundation of this effort is the evaluation of practices which can enhance soil quality and increase water infiltration and water-holding capacity. The forest sector places more emphasis on longer-term climate scenarios and their anticipated interaction with forest stressors. In both sectors, an adaptation workbook approach can help integrate climate variability and change into objectives-based planning. This training, co-hosted by the, USDA Climate Hubs, NRCS and Northern Institute of Applied Climate Science will introduce adaptation concepts and strategies; identify actions that enhance the resilience and adaptability of systems; and describe real-world examples of adaptation. Training materials and resources will be provided.

Lyric II

10:10 – 11:10 **Benefits of Spatial Data Structure, Consistency and Standards**
Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS
Adolfo Diaz and *Joseph Brennan,* NRCS-Soil Science Division (R-10)

Increased spatial data availability coupled with rapid analysis is critical to the progression of the soil resource inventory from the atlas sheet to the Major Land Resource Area (MLRA). When available in a structured and comprehensive local archive, spatial data can be mined for analysis and reported in a consistent manner. Consistent analysis can lead to standardized data population of key data elements within a soil map unit, while eliminating some of the misrepresentations and inefficiencies confounding any user group with varying skillsets. In this technology transfer session we will share a regional approach to standardizing MLRA-wide spatial datasets, some tools that have been developed to help assess the current state of our map units and other tangible benefits that have come from having a consistent and structured geospatial data. Further we will use slope gradient to illustrate how consistent and structured spatial data at the scale of the MLRA can coalesce with Regional Standards for considerations in the development of MLRA map units and components within. This approach attempts to merge conventional considerations in map unit design with the aforementioned tools and data.

Oral Presentations

10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior

11:15 – 11:25 a.m. **Disaggregating and Harmonising Soil Maps Using DSMART**
Budiman Minasny, University of Sydney

Conventional soil maps are usually represented of polygons described as mapping units, where each mapping unit consists of several soil classes with a given proportion. Many users would find it challenging to use these maps as the spatial distribution of the soil class is unknown. This presentation discusses a spatial disaggregation method called DSMART, Disaggregation and Harmonisation of Soil Map Units Through Resampled Classification Trees" . DSMART attempts to estimate the probability of occurrence of the individual soil classes using classification trees algorithm with the help of environmental covariates. We illustrate the application of DSMART in producing soil class maps, and subsequently generating soil property maps in Australia.

11:25 – 11:35 **Variation in a 1 x 1 m Soil Profile Wall**
Jenna Grauer-Gray and Alfred Hartemink, Soil Science Department, University of Wisconsin – Madison

We explored the amount of horizontal and vertical variation of soil properties in a 1 x 1 m soil profile wall at the West Madison Research Station in Verona, Wisconsin. We divided the soil profile wall into a 10 x 10 cm raster and took soil samples from the center of each square. We measured moist and dry color, texture, pH, and iron, manganese, and soil organic carbon content of each sample. Analysis of these properties showed considerable horizontal variation. For example, Fe content had a maximum horizontal range of 8,200 mg/kg, and soil organic carbon content had a maximum horizontal range of 19 g/kg. There was also considerable vertical variation. For example, standard deviations of Fe content varied from 880 mg/kg at 60-70 cm to 2,500 mg/kg at 10-20 cm, and standard deviations of soil organic carbon content varied from 0.45 g/kg at 40-50 cm to 7.1 g/kg at 70 to 80 cm. These results have some implications for sampling pedons and defining their horizons.

11:35 – 11:45 **Development of Computer Systems for Soil Survey**
David Hoover, USDA-NRCS

The NRCS maintains several data collection systems (NASIS, ESIS, LIMS, others) as well as numerous information delivery systems (Web Soil Survey, Soil Data Access, Soil Data Viewer, others) for soil survey and soil investigations. The talk will review the development and support stages for these and other systems through project initiation, business requirement documentation, cost analysis, project funding, development and long term maintenance. Attendees will not only gain an appreciation of the process but will understand the mechanisms for requesting enhancements and changes.

11:45 – 11:55 **USDA-NRCS Soil Monitoring Network: Concept and Design**
Larry West, NRCS (retired); *Mike Sucik* and *Jon Hempel*, NRCS

A national-scale soil monitoring network (SMN) is proposed to track changes in soil properties related to soil and agricultural management systems, conservation programs, and climate change. The spatially distributed data will augment soil survey information and provide additional data for inventory of soil health, dynamic soil properties, soil change, and ecological sites. The data coupled with simulation models also will provide insight into resource trends to help inform agricultural policy and NRCS program initiatives. The SMN will be based on the NRI statistical design and will rely on the repository of NRI and CEAP land use and management information to develop trends in changes of soil properties related to agricultural management. The Network will strive to involve key partners (ARS, Forest Service, NEON, and universities) to incorporate and augment data collected in ongoing research and monitoring programs. The SMN will include cropland, grazing land, and forest land and should include sufficient sites to achieve an acceptable level data confidence; use permanent, precisely marked sites to enable 5-10 year return frequency sampling over a 100 year time period; and use sampling and measurement protocols that will minimize operator error/variability and enable multiple sampling teams to collect field data and samples.

11:55 – 12:05 p.m. **Creating Custom Soil Databases (gSSURGO)**
Steve Peaslee, USDA-NRCS National Soil Survey Center

gSSURGO is a relatively new product that provides detailed soils information in the form of an ESRI® file geodatabase. This database format overcomes size limitations inherent to the original SSURGO database, making it easier to perform state-wide, regional or nation-wide analysis. Recently, USDA-NRCS released a public version of the Python-based ArcTools (SSURGO Download Tools) which are used to automate the process of creating gSSURGO. These tools incorporate methods for acquiring large quantities of SSURGO data, merging those data and converting them to the gSSURGO geodatabase format. The tools are also used to build the raster layers and to create the metadata required for distribution via the Geospatial Data Gateway. The public release will allow modelers to build gSSURGO databases for custom areas of interest such as large watersheds or ecological regions. Additional tools are available that will facilitate the creation of multi-survey areas SSURGO databases when compatibility with Soil Data Viewer software is an important requirement.

12:05 – 12:15 p.m. **Open Discussion**

Training Sessions
60 Minutes Each

Lake Erie

11:15 – 12:15 **Soil Data Access Site**
Moderator: *Patty Burns,* MLRA SS, Bemidji, MN, USDA-NRCS
Paul Finnell, USDA NRCS NSSC

The Soil Data Access (SDA) is a very powerful, yet the most underutilized, web application for retrieving the Soil Data Mart information. Created in 2003, the Soil Data Access allows users to query the soil data mart database to retrieve specific data sets. The SDA has the capabilities to:

Provide a way to request data for an ad hoc area of interest of any size.

- Provide a way to obtain data in real-time.
- Provide a way to request selected tabular attributes.
- Provide a way to return tabular data where the organization of that data doesn't have to mirror that of the underlying source database.
- Provide a way to bundle results by request, rather than by survey area.

Using the gSSURGO raster maps, the CONUS property and interpretation maps are easily created for display. The sql is tailored to the user need, and the results are joined to the 10m or 30 m raster maps. The training session will show the SSS and cooperators the SDA capabilities and to allow them to learn the minimal SQL skills needed to query the database and join to the spatial dataset for creating and marketing maps of soil properties, qualities and interpretations. The SDA has capabilities far beyond the limited use of the Soil Data Viewer. Understanding the capabilities and differences is the knowledge to be transferred in this session. The training session will familiarize the SSS and cooperators with the product capabilities needed to assist their customers.

Lake Ontario

11:15 – 12:15 **Soil Science: Using Social Media & Social Networking for Best Results / Communications and Information Options**

Moderator: *Mike Walczynski*, ARSS, Duluth, MN, USDA-NRCS
*Janine Anderson***,** NRCS / *Tammy Cheever*, USDA-NRCS-NSSC

Social media is a collection of internet-based tools that allow individuals to collaborate, create, and share digital content with one another. Social networks involve social interactions and relationships. Advancements in communication technology has caused a rapid expansion of the global social network and the use of social media tools within the last ten years. Social media and social networking, when used correctly, advances the discipline of Soil Science by facilitating scientific conversation and has dramatically increased outreach efforts. The purpose of this presentation will be to discuss the six types of social media and the role that social networking plays. There will also be participant discussion on what type of social media and social networking efforts are currently going on in the places where they live and work and what more could be done to advance the discipline of Soil Science.

Provide training on the many ways to communicate and to share information with others in NCSS beyond just email. How do you know which application (GovDelivery, USDA Connect, Web page, etc.) to use and when to use it? How do you find information? The number of options available can be overwhelming. This training is intended to guide you through some of these options.

Lyric I

11:15 – 12:15 p.m. **Selection of Soil Health Indicators Using the Soil Health – Rapid Assessment Tool (SH-RAT)**

Moderator: *Mike Rokus*, MLRA SS, Duluth, MN, USDA-NRSC
Skye Wills, Cathy Seybold, and *Linda Scheffe,* USDA-NRCS-National Soil Survey Center

The Natural Resource Conservation Service has a major initiative and a new division in support of the term of soil health. The first phases of this effort involved raising awareness among conservation planners, soil scientists and the public. Specific practices, such as cover crops, have been promoted to support and encourage soil health. As part of the NCSS's ongoing support for this project, we have developed a tool to assist land managers in assessing soil health: Soil Health – Rapid Assessment Tool. The tool walks the user in assessing soil conditions, selecting soil health indicators and using appropriate methods to measure those indicators. Then the tool applies a simple metric to give a soil health assessment and give some basic management considerations. This training will present the background information behind SH-RAT and ask participants to evaluate the logical connections between soil conditions, relevant indicators and appropriate methods for assessment. First participants will be given information about the tool's inputs and connections. Participants will be given an example field and resource concerns for a hands-on demo of the tool. Then users will be asked to imagine a scenario from the area where they work. The training will conclude with a discussion of the appropriate use, promotion and cooperation potential, and resources needed to improve the tool.

Lyric II

11:15 – 12:15 **Determining HEL Status Using GIS Model**
Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS
Kevin Godsey, NRCS

Determine HEL soil status using GIS Modeling techniques with LIDAR data and frozen HEL maps. LIDAR datasets have one meter pixels with 15 cm relative elevation precision. This allows us to calculate slope and slope length with a large degree of precision. The digital HEL soils map allows us to apply the fixed HEL values to the area in question. The GIS Model calculates the EI in a relatively short time span with a click of a few buttons.

12:15 – 1:15 **Lunch (on your own)**

Oral Presentations

10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior

1:15 – 1:25 p.m. **Technical Soil Services: Where the Rubber Hits the Road for Soil Science**
Michael Robotham, *Linda Scheffe*, and *Lenore Vasilas*, USDA-NRCS

Technical Soil Services (TSS) is the term used by the USDA-NRCS to encompass the broad range of activities conducted by agency personnel to support the use of soils information by a wide range of internal and external customers. Although TSS has always been a component of the overall soil survey and soil science programs within the agency, it has taken on greater importance and emphasis in recent years as initial soil survey inventory activities are completed for the vast majority of the United States. This presentation will summarize information on the number and scope of reported TSS activities over the past 3 fiscal years (FY2012, FY2013 and FY2014) conducted by the nearly 500 working soil scientists employed by USDA-NRCS nationwide. It will highlight both areas of current activity and potential future emphasis. The presentation will also highlight some specific examples of the many creative and innovative ways that NRCS Soil Scientists are providing Technical Soil Services to internal and external customers.

1:25 – 1:35 p.m. **Expanding Soil Survey Activities for Tribal Conservation Districts in Alaska**
Shawn Nield, NRCS - Soil Survey Region 1 Alaska; *Kyle Stephens*, NRCS-Alaska; *Cory Cole*

Land ownership in Alaska (AK) is split primarily between US federal government and Tribal entities. Tribal entities own about 90 percent of private lands in AK. Historically, soil survey activities in AK have been focused on municipalities or federal lands under reimbursable agreements due to the great expense associated with logistical and safety considerations. Soil survey products are needed for newly formed Tribal Conservation Districts (TCDs). Increased efforts to prioritize and expand soil survey work on tribal lands are highlighted herein.

1:35 – 1:45 **Soil Health, Soil Quality, Soil Indicators, and How The Bureau of Land Management (BLM) Uses Soil Information**
Scott Davis, Bureau of Land Management

The National Cooperative Soil Survey is the foundation of BLM's Assessment, Inventory, and Monitoring (AIM) process which collects the status, condition, trends, amount, location, and spatial distribution of our renewable resources.

1:45 – 1:55 p.m. **Centroids as the Basis for Universal Soil Classification**

Jon Hempel, USDA-NRCS; *Erika Micheli*, Szent Istvan University, Godollo, Hungary; *Vincent Lang*, Godollo, Hungary; *Alex McBratney*, University of Sydney

The concept of the IUSS Working Group for Universal Soil Classification system is based on a data centroid approach. This involves analyzing databases from across the world, using accepted diagnostic feature concepts, to make allocations into logical clouds or clusters of points that recognize "Great Soil Groups." These will be equivalent to the great group level from U.S. Soil Taxonomy, along with similar levels in the World Reference Base, Australian Soil Classification, and other defined soil classification systems. There are documented correlation potentials between different soil taxonomic systems using soil taxonomic distance calculations. The Great Soil Groups will have taxa developed that can document more and less detail. Lower taxa in the system will potentially recognize anthropogenic features, family criteria, and other important use and management characteristics. Higher taxa in the system will be developed for meso and macroscale applications. As more data are added to the system, taxonomic distance calculations can be used to determine if new categories are needed based on tolerances that are set. The system can then be more scalable based on the objective analyses of the data that are collected and entered into the system. Point data has been assembled from available databases across the world including 42,000 profiles from the US National Cooperative Soil Survey database, 3000 profiles from the ISRIC-WISE 3.1 dataset, 11,000 profiles from the AFSIS legacy database and an additional 1200 profiles were assembled from the Hungarian database and 680 profiles from the Russian database that have been used to develop the first iteration of a functional centroid based Universal Soil Classification System.

1:55 – 2:05 **Fundamental Changes in Soil Taxonomy Task Force**

Brian Needelman, University of Maryland; *Mark Solt*, University of Rhode Island

The Soil Science Society of America has created a Task Force to develop and facilitate the implementation of fundamental changes of Soil Taxonomy. These changes are intended to decrease the complexity and increase the ease of use of Soil Taxonomy such that it can and will be used by more than experienced pedologists. Guiding principles for the task force include solicitation of broad input from both the U.S. and international community, having minimal negative effects on existing National Cooperative Soil Survey mapping products, complementing concepts used in other soil taxonomic systems, and retention of knowledge embedded in the current system. This presentation will cover the background, rationale, objectives, guiding principles, and current activities of this task force including an update on active work on initial proposed changes. We will also discuss how members of the National Cooperative Soil Survey can stay aware of and contribute to this effort.

2:05 – 2:15 p.m. **Open Discussion**

Training Sessions
60 Minutes Each

Lake Erie

1:15 – 2:15 p.m. **Summarizing NASIS Data Using R Reports**

Moderator: *Patty Burns*, MLRA SS, Bemidji, MN, USDA-NRCS

Stephen Roecker, NRCS-IN; *Dylan Beaudette*, NRCS-CA; *Jay Skovlin*, NRCS-MT; *Skye Wills*, NRCS-NSSC

R is a new addition to soil scientists' toolbox, which includes custom functions designed for quantitative pedology, digital soil mapping, and soil physics. These functions streamline the analysis of soil data by making it easy to import data from NASIS into R and integrate it with other environmental datasets. Presently no other program offers similar functionality. In the complicated world of soil databases and ever-increasing spatial data, R is a critical tool for soil scientists. This training season will provide a brief introduction to R, and demonstrate how to run existing html reports that combine NASIS and GIS data using RStudio. These html reports were developed by the Western Regional Technology Committee to provide standardized summaries and graphics of data commonly used for SDJR, OSD development, map

unit development, and competing dissimilar soils. With little prior knowledge even novices can quickly generate their own results. Examples can be viewed at, https://github.com/sroecker01/soil-pit/tree/master/examples, where development is on-going.

Lake Ontario

1:15 – 2:15 **Soil Systems**

Moderator: *Mike Walczynski*, ARSS, Duluth, MN, USDA-NRCS
Philip Schoeneberger, *Doug Wysocki*, *Zamir Libohova*, and *Ellis Benham*, NRCS

A training session on the Soil Systems framework for quantifying, evaluating, and delivering soils information to diverse stakeholders will be presented. Catenas provide spatial relationships of different soils in an integrated whole, which capture relationships not obtainable by studying isolated soil pedons or map units. Catenas are an effective way to connect point data (e.g. pedon or site specific information) into a larger context and thereby identify functional landscape units. This enables moving beyond isolated / static information into connected, dynamic processes and ecosystem function. Groups of catenas form Soil Systems and link groups of soils through space and time. Discussions will cover the approach, assembly, utility, and applications of Soil Systems.

Lyric I

1:15 – 2:15 **Utilizing Spatial Analysis to Apply Hydrogeomorphic Principles to Ecological Site Differentiation**

Moderator: *Mike Rokus*, MLRA SS, Duluth, MN, USDA-NRSC
Richard Weber, and *Dwain Daniels,* USDA-NRCS

Utilizing ArcMap, SSURGO data, and the new gSSURGO data, users can employ various spatial approaches to assist with aggregation of components into draft Ecological Sites (ESs)/Hydrogeomorphic (HGM) groups. These spatial approaches utilize the data inherent in the SSURGO database, along with hillshade, DEM, and LIDAR data, to create watershed-scale assessments of landscape position, slope, runoff, catchment size, flow rate, and stream order. These parameters can greatly enhance the rigor and qualitative aspects of differentiating ecological sites, especially those that are hydrologically driven. Based on these types of spatial analyses, users can disaggregate map units into components, which may then be grouped into different ESs based on HGM principles, such as SLOPE headwaters systems, DEPRESSIONAL systems, or RIVERINE systems. The parameters for defining "wet" ES site concepts within an MLRA framework can also then be articulated, modeled, and tested in the field.

Lyric II

1:15 – 2:15 **NCSS Soil Laboratory Data Utility for CEAP Modeling Efforts**

Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS
Carrie-Ann Houdeshell, *Charles M. Ogg*, *Glenn Stanisewski*, and *Drew Kinney*, USDA-NRCS

The Conservation Effects Assessment Project (CEAP) was established in 2002 to evaluate the environmental benefits of conservation practices at national and regional levels and to identify priority acres – those most in need of conservation treatment. In 2014, NRCS established four regional modeling units (RMUs) within the Soil Sciences Division to work collaboratively with the NRCS Resource Assessment Division's (RAD) CEAP Modeling Team. The RMUs use the Agricultural Policy/Environmental Extender Model (APEX) to assess the effects of conservation practices on croplands. APEX relies on weather, hydrology, crop growth, crop management, and soil data. One focus of the RMUs is to update the soil data. Soil data presently used is the layer data from the Soil Interpretation Records (SIR). RMUs are locating the best available pedon data from NCSS Soil Characterization Database or research studies to replace SIR layers with actual horizon data. Synoptic review indicates many pedons are not fully characterized, or many soil series are lacking available data entirely. RMUs will work with MLRA ROs and SSOs to identify important soil series and soil properties needing further characterization. Utilizing appropriate soil data will improve APEX predictions.

Oral Presentations

10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior

2:30 – 2:40 p.m. **Ecological Classification on the White Mountain National Forest Using the Soil Inference Engine**
Robert A. Colter, U.S. Forest Service

The U.S. Forest Service (White Mountain National Forest, Eastern Regional Office, and Northern Research Station), Natural Resource Conservation Service (St. Johnsbury MLRA office), and the University of New Hampshire established a partnership in 2011 to increase the understanding of soil-site-vegetation relations on the White Mountain National Forest with a collective goal of producing fine-scale Terrestrial Ecological Units (TEUs), Ecological Site Descriptions (ESDs) and wed based soil map units. These products will help fulfill the Forest's basic need for land capability information for developing and executing land management plans and component projects. The initial impetus of this project was to identify and test cutting-edge technologies and employ robust sampling methods and statistics in hopes of improving mapping efficiencies and developing high-quality products at minimum cost. To support this effort, high-resolution land surface and vegetation signatures were derived from light detection and ranging (LiDAR) data. Next, LiDAR data were subjected to NRCS's knowledge-based raster "Soil Inference Engine" to create preliminary ecological map units. These preliminary ecological map units, in turn, served as a basis for field sampling design; i.e., the random placement of data plots for data collection. The project is ongoing and is concentrated on a 20,000 acre watershed as the test area. This watershed covers the full range of soil parent material, elevation, and moisture-nutrient gradients of the forest. Approximately 200 soil-site-vegetation test plots to be completed over two field seasons (2013-2014) have been randomly assigned based off of environmental conditions. Currently, multivariate statistics (Nonmetric Multidimensional Scaling) are being conducted to establish soil-site-vegetation relationships which will form the basis of ecological mapping units and descriptions.

2:40 – 2:50 **Ghosts of The Red Spruce Forest: The Need for an Evolving Soil Survey for Ecological Sites**
Travis Nauman, and *James A. Thompson*, West Virginia University Division of Plant and Soil Sciences; *Stephanie J. Connolly*, USDA-USGS Monongahela National Forest; *S. Jason Teets*, USDA-NRCS Major Land Resource Area 127 Field Office

Defining ecological sites (ES) requires a multidisciplinary perspective that may not always match the concepts used to create soil map units. This can create a disconnect in efforts to correlate ecological site descriptions (ESD) to soil components. Pedological concepts may need to be revisited and updates made to soil maps to accommodate ecological dynamics. In the central Appalachians, ES with red spruce (Picea rubens) compositions linked to spodic soil properties not fully reflected in the original SSURGO data exemplify this scenario. Digital soil mapping efforts, along with a recorrelation of existing SSURGO map units, were employed to better reflect historical records of much larger extents of spruce communities. This correlated to a much broader spatial range of spodic soil properties than originally mapped in SSURGO. The loss of spruce over much of its historical range has resulted in substantial carbon emissions and reduced habitat for threatened and endangered species, highlighting the importance of restoring these ecosystems. Principles of pedomemory, soil traits indicative of historic environments, were applied to help inform these updates and show potential for other similar efforts. In an era of emerging spatial technologies, SSURGO should be scrutinized using these and similar tools to better incorporate ecological concepts. Because the focus of the county soil surveys encompassed by SSURGO were pragmatic management issues (e.g., crop and development suitability), it should be recognized that updated future versions of SSURGO are necessary to accommodate new conceptual and spatial needs.

2:50 – 3:00 p.m. **Using ESDs for Greater Sage Grouse Management**
Erin Hourihan, USDA-NRCS
Communicating the utility of Ecological Site Descriptions (ESDs) is vital to their widespread acceptance and use. The NRCS is currently coordinating a national effort accelerating ESD development across the US,

ESDs will soon be available to our partners and producers for a variety of land management needs. It is important potential users understand where to find information contained in an ESD and how the information can be interpreted. This presentation walks through an example of how to apply an ESD to a habitat management scenario, specifically focusing on dominant species characteristics, the STM and the STM narrative. ESDs are useful for predicting seasonal preference, identifying at-risk plant community phases to focus management efforts and identifying compatible uses. This example will focus on the Greater Sage-Grouse (Centrocercus urophasianus), a sagebrush obligate species, currently considered a candidate for the threatened and endangered species list. However, the method used to determine habitat suitability for Sage Grouse can be applied to other management situations, such as; sheep or cattle grazing, large ungulate management, or recreation management. Users and partners will benefit from seeing an ESD applied to management in a real world example. Demonstrating the value of the ESD will help both the people using the ESDs, as well as, people developing these documents gain a much better understanding of the power of this tool for land management.

3:00 – 3:10 **Forest Service National Perspective on Implementing Ecological Site Classification and Descriptions**
John Lane, Dave Cleland, *Alix Cleveland* and *Harbin Li*, US Forest Service

There are multiple documents that establish goals, policy, and mechanisms for interagency cooperation among the Forest Service, Natural Resource Conservation Service, and Bureau of Land Management. These documents range from Memorandums of Understanding to interagency manual and handbook direction. As a land management agency, the Forest Service has different business needs as compared to those of NRCS. In addition to different business needs, land management agencies also have different work force needs, issues, and priorities. The Forest Service is participating in the development of a "National Ecological Site Implementation Plan" based on the guidance contained in the Rangeland Interagency Ecological Site Manual and the Interagency Ecological Site Handbook for Rangelands. This plan will identify how the agencies should implement the creation, classification, and description of Ecological Sites. We highly encourage broad cooperation, a common language, and effective communication. Many areas of great success exist, but some areas of concern remain. The Forest Service has been classifying multi-factor ecological types and mapping ecological units as a matter of practice for many years, and is committed to contributing to Ecological Site development on rangelands of the National Forest System.

3:10 – 3:20 **Considerations for Applying Digital Soil Mapping to Ecological Sites**
Matthew R. Levi, Brandon Bestelmeyer and *Joel Brown*, USDA-ARS Jornada Experimental Range; *Travis W. Nauman*, West Virginia University Division of Plant and Soil Sciences

Recent advancements in the spatial prediction of soil properties are not currently being fully utilized for ecological studies. Linking digital soil mapping (DSM) with ecological sites (ES) has the potential to better land management decisions by improving spatial resolution and precision as well as quantifying uncertainty of environmental information. Current spatial representation of ES largely depends on soil survey data. Any discrepancies in soil survey data are carried forward into ES inventories and interpretations. Recent advances in DSM technologies have focused on identifying unique soil components (disaggregating soil map units) and mapping continuous soil properties and associated uncertainty to improve soil data products. Soil surveys often do not discriminate properties important to ecosystem variation because of mapping limitations, yet subtle soil variations within map units or components may have important consequences for vegetation and ecological dynamics. Detailed maps of soil properties linked to important ecological variables could improve explanations of ecosystem patterns and dynamics. A recent workshop was held at the Jornada Experimental Range to bring together NCSS partners experienced with ES and DSM to initiate integration of these efforts. The application of DSM for ecological site development and mapping could help attain goals of the NRCS, BLM and USFS to produce ES products for improved land stewardship. We present a vision of how coupling DSM and ecological site descriptions could change the way we produce and consume ecological information.

3:20 – 3:30 p.m. **Open Discussion**

Lake Erie

2:30 – 3:30 p.m. **NASIS – Present and the Future: NASIS 7.2 and Beyond**

Moderator: *Patty Burns*, MLRA SS, Bemidji, MN, USDA-NRCS
George Teachman, NRCS-NSSC

The session is divided into two parts. The first part of the session will be two short presentations. There will be a general presentation on the current state of the NASIS umbrella. This will include a short discussion on the recent updates to the interface, data collection/reporting tools, and the data model. There will also be a general presentation of what the futures of NASIS may hold. This will be a vague discussion on the long term future of NASIS. The majority of the session will be an interactive audience participation session. Attendees will be solicited for suggestions on how to improve any piece of the NASIS umbrella and for any additional capabilities to the NASIS tool set. At this time, it is hoped that members of the audience will tell the presenter their suggestions for the improvement of NASIS and for suggestions on the future direction(s) of NASIS. The results of this interactive session, will, in large part, direct the future development of NASIS.

Lake Ontario

2:30 – 3:30 **Basic Tools for Digital Soil Mapping**

Moderator: *Mike Walczynski*, ARSS, Duluth, MN, USDA-NRCS
Tom D'Avello, *Suzann Kienast-Brown*, *Zamir Libohova*, and *Katey Youst* USDA-NRCS; *James Thompson*, West Virginia University

A succinct definition of digital soil mapping (DSM) is the production of soil class or property maps using geospatial techniques and software. DSM methods are amenable to investigations in mapped or unmapped areas. The factors of soil formation as defined by Jenny and modified by McBratney, et.al. will be discussed. The process of using environmental factors, defined as raster data covariates, to assist in the identification and mapping of soil classes or properties will be introduced. We will discuss the data used in the DSM environment as a subset of the data used by conventional methods. Best practices for developing and assembling covariates, including various software tools and packages will be described. The process of associating field collected data with covariates and methods for exploring data will be presented. Examples will show the procedure of rule-based and classification tree techniques using commonly available ArcGIS and R software. This session will be most useful for participants familiar with using raster data, ArcGIS Spatial Analyst and an awareness of basic statistics. Participants will leave with the background and instructions to evaluate data more objectively and use the software available in their office as a more effective tool in their work.

Lyric I

2:30 – 3:30 **Introducing ICOMTAX; the International Committee for Soil Taxonomy**

Moderator: *Mike Rokus*, MLRA SS, Duluth, MN, USDA-NRSC
Ken Scheffe, USDA-NRCS-NSSC

Soil Taxonomy has been the soil classification system in use in the US since 1975. In order to continue improvement in Soil Taxonomy and broaden interests and global application, an International Committee on Soil Taxonomy (ICOMTAX) is being established to actively promote participation from the international community. ICOMTAX will review proposed amendments to Soil Taxonomy that have international application and impact. It will recommend provide analysis of global scope and impact of proposed amendments and develop recommendations regarding acceptance. ICOMTAX will serve as a permanent standing committee for the Director of the Soil Science Division, It will consist of NCSS (US) and International Soil Scientists. This will include the recognized international leaders and experts in soil classification systems and represent the broad diversity of soil landscapes, climates, land uses, and cultures of the six inhabited continents. In addition the NRCS is opening its processes for amending Soil Taxonomy for broader, more inclusive input, and more transparent review. Processes codified in the National Soil Survey Handbook outline the processes in review, deliberation, and integration of

amendments to Soil Taxonomy and other NCSS program standards and procedures.
Upon completion of the training, the participants will:

1. Understand the role and of US Soil Taxonomy in the international soil classification community.
2. Understand the purpose, makeup and operational procedures of ICOMTAX.
3. Know the role and charges to be considered by ICOMTAX.
4. Know the process by which recommendations will be received and reviewed.

Lyric II

2:30 – 3:30 p.m. **The Update of Agriculture Handbook 296**

Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS
Susan Southard, Paul Finnell, Steve Peaslee, and *Ken Scheffe,* USDA-NRCS

Agricultural Handbook 296 (AH 296) represents an assemblage of information, in the form of a map with descriptions, about using land for farming, ranching, forestry, engineering, recreational development, and other uses. Criteria for developing NRCS land resource maps and descriptions are documented in National Soil Survey Handbook (NSSH) Section 649 which has recently been updated. The framework and procedures used for modifying the existing maps and descriptions of Land Resource Regions (LRRs), Major Land Resource Areas (MLRAs), or Land Resource Units (LRUs) are also outlined in Section 649. We are initiating an update of AH 296, which was last updated in 2006. The 2016 update will focus on adding the hierarchy of Land Resource Units within the maps and descriptions. From June until October 2015 we propose a comment period where the incorporation of LRUs can be reviewed. All proposals will be compiled by the Regional Offices and forwarded to the Director, National Soil Survey Center for review and preparation into the 2016 AH 296 publication. Review of comments by National Soil Survey staff will conclude by March 2016 whereupon final cartographic and publication processes will begin with a publication target date of October 2016. Changes to resource maps and descriptions can be requested by States, Soil Survey Regional Offices and cooperators. This training session will explain the LRR/MLRA/LRU criteria and individual cartographic standards and will invite initial comments on the 2016 update to the AH296.

Ballroom Lobby

3:30 – 4:00 **Break**

Oral Presentations

10 Minutes Each with 10 Minute Discussion at the End of the Last Session

Moderator: *Joe Kristoff*, Resource Soil Scientist, Marshall, MN, USDA-NRCS

Lake Superior

4:00 – 4:10 **Using One National Dataset to Build Another: Leveraging LANDFIRE Data and Models in Ecological Site Description Development**

Randy Swaty, The Nature Conservancy; *Jason Teets*, USDA-NRCS

The NRCS is currently working to finish development of Ecological Site Descriptions (ESDs, http://goo.gl/p5ILvG) for the US, a mammoth task by any measure. These ESDs classify and describe forest and rangelands, providing valuable information for managers. The LANDFIRE program (www.landfire.gov) has developed and delivered dozens of spatial datasets that cover the United States. These datasets cover many vegetation and fire concepts including potential natural vegetation, historic fire regimes, existing vegetation height, cover and type. Additionally, LANDFIRE has also described how all the natural ecosystems looked and worked during natural disturbance regimes. While developed for large scale applications, LANDFIRE products can help contribute to the ESD mapping effort due to the wall to wall coverage and unique themes mapped. Here we will:

1. Give a brief overview of the relevant LANDFIRE products.
2. Demonstrate acquisition and manipulation of LANDFIRE spatial data and ecological models.
3. Using real, live examples explore potential ways to use, and ways not to use LANDFIRE data.
4. Summarize the complimentary nature of the NRCS and LANDFIRE products.

4:10 – 4:20 p.m. **Complexity of "Unhelpful Resilience" and Its Effect on Northern Appalachian Forests and Wetland Ecosystems**

Patrick Drohan, Penn State, Ecosystems, Science and Management

Unhelpful resilience is resilience that helps to maintain an ecosystem in a degraded state following a disturbance. Across the Northern Appalachians many examples exist of such resilience, which complicate development of accurate State and Transition Models. Forest and wetland ecosystems are a current area of focus for Ecological Site development along a large extent of the Northern Appalachians, specifically in MLRA 127. Historical disturbance has led to numerous states of the MLRA's Ecological Sites. We present results of several long-term research projects in forest and wetland communities in order to demonstrate how historic disturbance in these ecosystems has resulted in "unhelpful resilience" and thus maintained degraded States. This provides a conceptual framework for future manipulative experiments, which could be conducted to better identify thresholds of state changes in these systems.

4:20 – 4:30 **Environmental Variables Influencing the Distribution of Topsoil C in the Driftless Area of Wisconsin, USA**

Kabindra Adhikari and *Alfred Hartemink* Department of Soil Science, FD Hole Soils Lab, University of Wisconsin-Madison

We evaluated the importance of environmental variables to predict topsoil (0-20 cm) C content by developing a condition-based SOC prediction model using 540 pedons and 13 variables from a 5,200 ha area in the driftless area in Wisconsin. The model consists of a set of prediction rules that are only valid in a defined landscape condition where each rule comes with a specific multiple linear function to predict SOC in a given condition. The variables included in the study were: terrain attributes derived from a digital elevation model (9×9 m grid spacing), soil types, and land use information (grass land, and forest frequencies for each location between yrs 2003-2012). Variable importance was calculated as a relative usage of the variables in the prediction model and was expressed in percentage (RI %). It was found that land use information, and elevation were among the major variables (RI >80%) for the model used while setting the condition-rules whereas, terrain attributes like elevation, insolation, slope aspect, wetness index, and altitude above channel network were the key variables (RI >70%) used in the linear prediction function. We found a fair relation between soil orders, land use, and soil carbon levels. Under the forest, Inceptisols stored the highest amount of C (33 g kg-1) compared to Mollisols, and Alfisols whereas, in pastureland, Mollisols were richer in C (>23 g kg-1) than Inceptisols, and Alfisols. In the cropland areas, Inceptisols showed the maximum C levels (23 g kg-1) with Entisols storing the lowest C (18 g kg-1). Results from this study suggested that for any future C mapping studies in the driftless area, one should not forgot to include land use, soil types, and terrain attributes as identified above as primary C predicting variables.

4:30 – 4:40 **A Conceptual Framework for Raster-Based Interpretations**

Robert Dobos, Steve Peaslee, Zamir Libohova, and *Susan Southard,* NRCS-NSSC

Land use practices vary in the extent of the landscape that they occupy. Some practices, such as row crop farming, may occur on essentially all of a map unit polygon while some practices, such as a livestock shelter structure, may occupy only a small part of the landscape. Some practices, such as fencing, occupy a linear segment of the polygon. While traditional polygon-based interpretations deal with the first situation adequately, the latter examples are less well modelled due to the spatial variability of the soil components within map units. Conceptually, raster-based interpretations will use the soil property and site data associated with the digital soil mapping process to generate an interpretive output for each pixel of the raster product. Spatially explicit interpretive information at a ten meter or less pixel size would make economic and ecologic factors of the planning stage for land use more precise, since more information on the soil resource would be available. The best suited soils for a practice could be targeted while ecologically sensitive areas could be protected.

4:40 – 4:50 p.m. **Pedogenic Pathways in Volcanic Ash Mantles of the Inland Pacific Northwest**

Paul McDaniel, University of Idaho

The cataclysmic eruption of Mount Mazama ~7600 years ago deposited a mantle of volcanic ash across the Inland Pacific Northwest region. Collaborative research between the University of Idaho, USDA-

Natural Resources Conservation Service, and the US Forest Service has identified several different pathways of soil formation in forested regions influenced by this ash. Under the dominant climatic conditions of the region, weathering processes give rise andic soil properties, and allophanic Andisols and Andic- subgroups dominate the landscape. At higher-elevation sites with greater precipitation and lower solar insolation, podzolization processes are favored, resulting in formation of Spodosols and Spodic intergrades. These soils are extremely acid and have high aluminum activity as a result of podzolization. In areas where stand-replacing disturbance has occurred, soil genesis may proceed along two pathways. Where bracken fern communities become established following disturbance, increased belowground additions of organic matter give rise to non-allophanic Andisols. As a result of this pathway, soils develop relatively high levels of exchangeable aluminum and do not appear to be conducive to conifer regeneration. In other areas, erosional processes following stand-replacing disturbance can result in partial to almost complete loss of the ash mantle. Vitrandic intergrades of other soil orders are common and the loss of water-holding capacity associated with andic properties can result in desertification, in which resultant soils are no longer able to support the forest communities that existed prior to disturbance. This research underscores the importance of environmental factors in determining the direction and extent of pedogenesis.

4:50 – 5:00 p.m. **Open Discussion**

Training Sessions
60 Minutes Each

Lake Erie

4:00 – 5:00 **Mapping with gSSURGO - Review of VALU Table Database Calculations and Their Application in the Landscape**

Moderator: *Patty Burns*, MLRA SS, Bemidji, MN, USDA-NRCS
Sharon Waltman, USDA-NRCS-NSSC-GRU

The popular Soil Survey Geographic (SSURGO) Database is available in the Web Soil Survey, but not easily used in national, regional and statewide resource planning and analysis of soils data. In 2013, USDA-NRCS added a new product designed to provide more ready access to soils information for large land areas by the simulation modeling community called gSSURGO (g for gridded). The gSSURGO Database is derived from the official Soil Survey Geographic Database each fiscal year and includes a new Value-Added Look Up (VALU) Table Database. In this database, the valu1 table provides pre-summarized map unit estimates of soil organic carbon, available water storage, National Commodity Crop Productivity Index, root-zone depth of commodity crops, available water storage within the root-zone depth, drought-vulnerable soil landscapes, and potential wetland soil landscapes. Selected theme's basic summary or aggregation methodology will be reviewed using the 5 steps of query documentation (identifying tables and columns, NULL-handling rules, criteria for selected set, calculation, and data summary methods used in mapping). Sample calculations for available water storage volumes and soil organic carbon mass and stock will be reviewed and mapped.

Lake Ontario

4:00 – 5:00 **Using the Knowledge Discoverer Module of ArcSIE for NRCS Soil Map Updating**

Moderator: *Mike Walczynski*, ARSS, Duluth, MN, USDA-NRCS
*Xun Shi, D*artmouth College; *Jessica Philippe*, 12-STJ SSO, USDA-NRCS; *Tom D'Avello*, National Soil Survey Center-Geospatial Research Unit, USDA-NRCS

Since 2005, NRCS soil scientists in Vermont have been working with an automated, knowledge-based approach to soil mapping. A major focus of this effort is computer software called the Arc Soil Inference Engine (ArcSIE). This software has been used successfully in a full production environment to complete an Order 2 soil survey in Essex County, VT and is being used for in-progress surveys in the White Mountain National Forest, NH and the Boundary Waters Canoe Area Wilderness in MN. One of the modules of ArcSIE is Knowledge Discoverer (KD), which is designed for soil survey update projects. A pilot project

conducted by the 12-STJ MLRA Soil Survey Office in 2012-2013 demonstrates a good potential of KD in MLRA soil survey updates. KD takes polygons from an existing soil map and user-specified environmental data layers as inputs. It then builds and displays the relationships between those polygons and the environmental factors in the form of relationship curves. The user is then able to evaluate and modify these relationships in both graphical and statistical ways. The updated relationships can then be used by ArcSIE's Inference Engine to create an updated raster map for the area. In this training session we will first present and discuss the general concept underlying the knowledge-based map updating approach adopted by KD, and then demonstrate the entire technical procedure of KD using actual case studies. We will also answer questions regarding the use of ArcSIE software.

Lyric I

4:00 – 5:00 p.m. **The Isee Project – Utilizing gSSURGO to Visualize Soil Landscapes and Soil Properties at Multiple Scales**

Moderator: *Mike Rokus,* MLRA SS, Duluth, MN, USDA-NRSC

Darrell Schulze and *Phillip Owens,* Purdue University; *Isee Project Collaborators*

The Integrating Spatial Educational Experiences (Isee, "I see") project utilizes gSSURGO data and best available elevation and other data to create highly detailed maps designed to visualize soil properties from field to global scales. These maps are designed specifically to integrate and highlight relationships between soils, soil forming factors, landforms, and land-use, and are delivered by an easy-to-use app for the Apple iPad. In this session we will provide an overview of the Isee project, provide hands-on training for the use of the Isee app, and describe how we created the maps available within the app. The project currently covers the states of Indiana, Wisconsin, Illinois, Kentucky, Ohio, West Virginia, and Texas at scales down to ~1:18,000 (~5 x 5 m pixels). The available maps were created by project collaborators in each state and include: soil orders, dominant soil parent material, natural soil drainage class, surface horizon color, fragipans, acid subsoils, and others, including informative historic maps when available. A variety of global maps including soil orders, soil moisture regimes, soil temperature regimes, population density, cultivated lands, and others are also available down to ~1:9,000,000. The project is designed to be extensible to other areas and additional maps can be added easily. The maps and iPad app support teaching and learning soil science for diverse audiences including beginning to advanced soil science students, new employees of NRCS, and the general public.

Lyric II

4:00 – 5:00 **Generating a Continuous Gridded Soil Interpretation from SSURGO**

Moderator: *Larissa Schmitt*, MLRA SS, Duluth, MN, USDA-NRCS

Zamir Libohova, *Steve Peaslee*, *Robert R. Dobos*, and *Maxine Levin*, USDA-NRCS-NSSC

The emergence of GIS and Remote Sensing technologies combined with high resolution spatial data and new demands has necessitated the production of spatially explicit soil information. The major goal of this project was the production of a continuous gridded soil interpretative map for fencing. Essex County in Vermont has a traditional polygon soil map and gridded soil component map making it suitable for the objective of this study. Three approaches for generating soil interpretative maps for fencing were tested and compared. The first approach included the traditional fencing interpretation developed at the SSURGO map unit level, based on percent weighted components contribution. The second approach generated a fencing interpretation at the component spatial level. The third approach required the development of input properties (depth to bedrock, seasonal high water table and slope) as continuous gridded (raster) layers for the generation of the soil interpretative map for fencing. The continuous gridded soil interpretation provided a spatially explicit suitability of the soil for fencing, which offers a better decision making tool for users. Other interpretations can be generated in similar ways, however, more work is needed on validation of such interpretative maps. The participants will be exposed to various tools and approaches to developing gridded continuous interpretations that will aid site specific decision management.

Minnesota Room

5:00 – 7:00 p.m. **Poster Sessions and Social**

Wednesday, June 10

6:30 a.m. – 8:30 p.m. **Field trip and MAPSS Social Event (***boxed lunch and dinner included***) – tickets required**
Buses will load on Level One of the hotel, at the Superior Street Entrance.

Thursday, June 11

Ballroom Lobby
7:00 – 8:00 a.m. **Coffee**

Moderator: *William Shoup*, State Soil Scientist, Denver, CO, USDA-NRCS

Great Lakes Ballroom
8:00 – 8:30 **Keynote Address on Introducing the New NRCS Soil Health Division**
Dr. Bianca Moebius-Clune, USDA-NRCS, Soil Health Division

Widespread adoption of soil health management systems has the potential to result in continental-scale, systemic improvements in environmental factors, farm resilience and productivity, as well as profitability. Concentrated efforts to improve soil health will thus provide significant return on the nation's conservation investment. The new NRCS Soil Health Division was initiated to leverage resources, skills, technology, and partnerships nationally to facilitate increased implementation of science-based, effective, broad-acreage soil health management systems on the nation's diverse agricultural lands. NRCS educational, technical, and financial assistance programs will be expanded and adjusted to implement key functions of the new Soil Health Division. These functions will include efforts to provide advanced soil health technical training and education to key stakeholders, to standardize and increase the use of publicly available soil health testing that leads to result-informed soil health management recommendations, to guide soil health management planning and implementation, and to monitor and adapt services for sustained, long-term adoption. Planned Soil Health Division activities and potential opportunities for collaboration will be discussed.

Great Lakes Ballroom
8:30 – 9:30 **Committee Reports**

Ballroom Lobby
9:30 – 10:00 **Break**

Great Lakes Ballroom
10:00 – 12:00 p.m. **Soils and a Changing Climate: Future Trends of the NCSS, a Town Hall Discussion about an NCSS Strategic Plan and the Path Forward for the NCSS**

Moderator: *Michael Whited*, Regional Director, Soil Survey Region 10, St. Paul, MN

Great Lakes Ballroom
12:00 – 12:40 **NCSS Awards Lunch** *(buffet provided)*

Great Lakes Ballroom
12:40-1:00 **Evolution of Wild Rice Management**
Thomas Howes, Fond du Lac Band of Lake Superior Chippewa

Great Lakes Ballroom
1:00-2:00 **NCSS Business Meeting**

2:00 **Adjourn**

Monday Posters

M-1
Colluvium Bluff Prairie Ecosystems
Peter Hartman, NRCS Earth Team Volunteer; *Michael England*, NRCS

Poster Describing and comparing two recently completed Ecological Site Descriptions: Dolomite Colluvium Bluff Prairie and Sandstone Colluvium Bluff Prairie. Poster consists of photos, diagrams, and text which highlight the soil – vegetation relationships that are now are correlated to soil map unit components. The Poster shows that the soils of these two forms of bluff prairies each support a unique plant community.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-2
Applying Random Forests Probabilities for Mapping Soil Classes in Remote Areas – Boundary Waters Canoe Area Wilderness (BWCA)
Suzann Kienast-Brown and *Tom D'Avello*, USDA-NRCS; *Colby Brungard*, Utah State University

Remote wilderness lands present a unique opportunity and challenge for resource inventory. Digital soil mapping (DSM) is an effective method for producing soil survey products in remote areas with access limitations. In 2012, the USDA-Forest Service (USFS) and USDA-Natural Resources Conservation Service (NRCS) began a collaborative soil survey project over 595,000 acres of unmapped remote wilderness land in the BWCA. DSM techniques using a combination of Landsat 5 spectral data and LiDAR terrain data were coupled with local expertise to produce a raster-based soil survey product. A 2013 field campaign resulted in 207 pedon observations in 15 initial soil classes. After evaluating class separability, 11 soil classes were modeled using multiple classification techniques, including random forests. Probability surfaces were created using random forests to model each class separately. The class with the maximum probability at each pixel location was extracted and used to create a final classified map for the 11 soil classes across the BWCA. This approach was chosen because the low separability between classes and limited training data resulted in poor random forests performance when all 11 classes were modeled simultaneously. An accuracy assessment using field validation points collected in 2014 resulted in an overall accuracy of 72% for the resulting map. The final publication-ready raster soil map is a combination of classes derived from random forests, knowledge-based classification, linear regression, and ISODATA unsupervised classification.

Topic Area: *Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-3
Collaborative Development of Ecological Site Descriptions for Adaptive Management of California Grasslands
Kendra Moseley, MRCS

Achieving conservation goals in California's spatially and temporally variable grasslands requires a management approach that is both opportunistic and adaptive. Ecological sites and state-and-transition models are ideal conceptual tools for such management. In 2008, when the Tejon Ranch Conservancy set out to develop an adaptive management plan to meet multiple conservation objectives for 240,000 acres of conserved lands, official, approved Ecological Site Descriptions were available for only a small fraction of sites to be managed. To describe and understand spatial and temporal dynamics across 100,000 acres of Tejon grasslands, the Conservancy partnered with the UC Berkeley Range Ecology Lab. Together they developed an "unofficial" ecological site classification based on top soils and topography at 57 study plots situated across the grassland landscape. Floristic surveys at the plots over five years informed models of inter-annual change for each ecological site. In 2013, the Conservancy incorporated their findings into an extensive adaptive management plan, and in 2014, NRCS ES specialists joined the partnership. Now we are working together to develop grazing trials to inform adaptive management, modify the models for wider interpretation, and provide baseline data for official Ecological Site Descriptions for the Tejon Ranch area.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-4

Soil Survey Contributions to USDA Climate Change Initiatives

Michael Wilson and *David W. Smith*, USDA-NRCS

Soils are an integral natural resource that must be evaluated to understand rural and urban land use vulnerability to climate change. This resource is also important for development of adaptive methods that build resilience to minimize the impact of climate change and to enhance mitigation of greenhouse gases. The objectives of this poster are to discuss activities within NRCS and the National Cooperative Soil Survey that contribute data and information for determining adaptation and mitigation measures for agricultural and other land use systems. Soil surveys segregate landscape properties, as well as measure differences within and among soils for pedon and horizon specific variables. These properties form a core data set, impacting productivity and resilience issues relevant to both potential climate change and extreme weather events. Thus, initial mapping and continued updating of soil surveys are critical to provide accurate and useful information, especially in front-line areas of climate change such as coastlines, northern forests, rangelands of the Southwest, Midwest cropping areas impacted by drought or water use limitations, and the Central Valley of California. Also, on-going research conducted on a landscape or watershed basis is vital to understand the connectivity of landscape position to water flow. This hydrologic component influences properties such as seasonal water availability, C sources/sinks, soil productivity, erosivity, and nitrate movement. Documenting these properties is important in supporting agency and departmental objectives but also for improving land use interpretations for the public in light of climate change.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-5

Correlating Ecological Sites with Soil Survey on the Southern Colorado Plateau

Jennifer Puttere, USDA-NRCS

Soil surveys and ecological sites must match on key components. On the southern Colorado Plateau, geology, landforms, precipitation zones, soil moisture and temperature regimes must be established before soil and ecological site correlation can continue.

Other key factors in both establishing ecological sites and distinguishing between a new ecological site and a state or phase of an existing site are:

1. The observation of dynamic soil properties,
2. Land use history, and
3. Disturbance.

This poster will show the current ways in which ecological sites are being separated. There are new methods being developed, such as in the use of statistical software. This software may be used in the future to distinguish within-site states and phases and among new ecological sites.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-6

Pedogenesis and Landscape Relationships of a Holocene Age Barrier Island

Ann Rossi, ORISE Research Program at US EPA Wetlands Division; *Martin Rabenhorst*, University of Maryland College Park

Soil characteristics and pedogenic processes are relatively unstudied on Holocene age barrier islands in the Mid-Atlantic region of the United States, despite their value for recreational, residential, commercial, and industrial development. In this study we examined soils across various barrier island landforms and drainage conditions to assess how landform stability and hydrologic condition water availability influenced pedogenesis. Ten topographic transects were established on different barrier island landforms which ranged in age from 1 to 228 years. The topographic transects spanned drainage conditions (ranging from very poorly to excessively drained). Pedogenic development was restricted by the young age and weathering resistant nature of the parent material. The primary evidence for pedogenesis across the chronosequence was in the accumulation of organic matter expressed in the formation of A and O horizons. Closer proximity of the water table to the soil surface was associated with greater inputs from vegetation and slower decomposition under anaerobic conditions, which together led to increased accumulation of organic carbon in lower, wetter landscape positions. Frequency and duration of saturation also impacted subsoil development, producing subtle, but noticeable color differences between oxidized and reduced horizons. This study also documents the presence of sulfidic materials in these non-tidal systems, raising additional questions regarding taxonomic classification.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-7
Soil Property Effects on Wind Erosion of Organic Soils
Ted Zobeck, USDA-ARS

Histosols are soils with more than 20% organic matter in half or more of the upper 30 inches. Estimating wind erosion on Histosols has been determined by USDA-Natural Resources Conservation Service (NRCS) as a critical need for the Wind Erosion Prediction System (WEPS) model. WEPS has been developed to simulate wind erosion on agricultural land in the US, including soils with organic soil material surfaces. However, additional field measurements are needed to calibrate and validate estimates of wind erosion of organic soils using WEPS. A field portable wind tunnel was used to generate air-borne particles and dust from agricultural surfaces for soils ranging from 17% to 67% organic matter (OM). The soils were tilled and rolled to provide a compacted, but loose surface. Blowing dust and sand were measured using a sampler at the wind tunnel exit. Dust samples were analyzed for physical and chemical properties. Particle density of the sand-sized material varied with OM content. The lowest OM soils had the highest dust concentrations. The soils with the highest amount of wind-erodible particles present (51-74%) had distinctly higher dust emissions compared with the other soils (<43% wind-erodible particles). These results demonstrate the following: 1) Surface soil organic matter content affected how wind eroded the soil and their dust emissions. 2) Differences in dust emissions can be linked to soil properties. 3) Simple mathematical models based on one or more soil properties can be used to estimate dust emission from organic and organic-rich soils.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-8
Dynamic Spatial Interpretations Tool
Jason Nemecek and *Chad Ferguson*, NRCS

These tools generates a thematic interpretation map in ArcMap for one of several soil survey areas or any National Soil Information System (NASIS) project.

- No external tabular data is required.
- No more running reports in NASIS or going to Web Soil Survey and linking interpretation data to Microsoft Excel or Access then joining the MUKEY to an ArcMap shapefile. (Which can be time consuming)
- Similar to Soil Data Viewer except the data is dynamic instead of static
- Produces the dominant condition for any interpretation
- The data is transactional (dynamic) from NASIS and not official such as Web Soil Survey. As data is edited in NASIS, the results are immediate to the tool
- When new interpretations are saved to NASIS they are immediately available
- The data is stored in a file geodatabase where the tool is stored.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-9
Tennessee Soil Interpretations
Doug Slabaugh and *Jason Nemecek*, NRCS

Local interpretations developed based on state criteria and discussions with partners can more effectively meet local needs and objectives. National Interpretations are nationwide in scope and may not reflect specific local conditions.
Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-10
Tennessee Water Table Study
Doug Slabaugh and *Jason Nemecek*, NRCS

Replace estimated data with actual data. Install 79 data sites (global water loggers record water table depth). Install 30 Iris tube sites to determine reduction.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-11
A Modest Proposal to Change the NASIS Data Structure
Steve Baker and *Jeff Glanville*, USDA-NRCS

Data elements such as Land Capability Class (LCC) and Productivity Index (PI) are commonly ensconced into local rules and regulations, and as data map unit elements these cannot be modified except by MLRA Staff. This presentation would be geared toward adding certain soil "performance" categories into the Legend map unit level of NASIS to allow the state soils programs to be responsive to internal and external customers.
Elements of the presentation:

- Review of AH 210 assumptions that support moving the LCC away from a component concept, and why the PI is not synonymous and also needs to be at the Legend Map Unit Level
- Brief overview of LCC and PI use in state code around the United States
- Tie all the above into a proposal to move these elements to the Legend Map Unit to allow Technical Soil Services to be more responsive to local requirements
- Q&A time for suggestions of additional "performance" elements to be added to Legend Map Unit, or arguments against the proposal.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-12
Penetrometer-Mounted VisNIR Spectroscopy: A Practical System for Field Implementation
Cristine Morgan, *Gregory Rouze* and *Jason Ackerman*, Texas A&M University; *Alex McBratney,* The University of Sydney

Accurate soil data is needed for land management decisions. Historically in the United States, soil has been characterized in the form of soil polygon map units delineated by expert knowledge and only recently been converted to a raster format. While these maps contain soil property data in a format suitable for interested users, spatial representation of the variability within and between map units can be improved to represent the actual soil variability at finer scales. Using aerial gamma radiometrics, as a covariate to improve soil maps is a proposed option. The overall goal of this research is to explore where previously measured gamma–ray emissions from the soil indicate changes in soil properties. Through this exploration, we identify soil properties that can be mapped, locations in the US where gamma-ray data show the most potential, and relationships between aerial and proximal gamma data.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-13
Soil Landscape Mapping on National Parklands in Alaska Using an Ecological Land Survey Approach
Aaron Wells and *Tracy Christopherson*, ABR, Inc. Environmental Research and Services

The broad expanses and remote nature of National Parklands in Alaska provide many challenges for mapping soils, including logistical and time constraints, foul weather, and the costs associated with study area access. The challenges associated with soil mapping in Alaska's National Parklands necessitates a rapid, efficient, and cost-effective methodology. An Ecological Land Survey (ELS) and classification provides such a method for describing, classifying, and mapping vegetation and soils. An ELS, in conjunction with a land-cover map, enables resource managers to more effectively evaluate land resources and develop appropriate management strategies. An ELS is an integrated approach that uses vegetation and soils field and laboratory data to inventory and classify ecological characteristics from the "bottom up," while using multivariate statistical analysis, GIS modeling, and remote sensing to better differentiate the distribution of ecosystems across space from the "top down." We present an overview of the ELS approach to mapping soil landscapes using examples from National Park Units in Alaska encompassing approximately 31 million acres that were surveyed between 2005 and 2015.

Topic Area: *Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-14
soils.usda.gov Highlights
Tammy Umholtz, USDA-NRCS-NSSC

This will be a poster that highlights parts of the soils.usda.gov website that are of interest to NCSS cooperators.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-15
Viewing Soil Survey Point Data in Google Earth
Jay Skovlin and *Dylan Beaudette*, USDA-NRCS

Google Earth (GE) is unsurpassed as a fast and powerful viewer of spatial information in a 3D digital globe environment. For soil survey applications, GE is particularly powerful for viewing point data. Files for Google Earth are written using GE's native format, Keyhole Markup Language (KML) and can be bundled or zipped together as KMZ files. Until recently, the availability of Google Earth for use on government computers has been limited to use of the licensed Google Earth Pro. Here we show several methods for generating KML files from NASIS using a report script, from Pedon PC, and using scripting approaches that use the soilDB and plotKML packages in R. Examples display embedded content such as html links to web-based NASIS pedon description reports, site and pedon photos with links to the external images, and html tables of vegetation species with cover percent for ESD development. Thus far, GE has been under-utilized in soil survey work, these examples are a small sampling of the possible uses with respect to viewing point data. Gridded and polygon data can be displayed in GE as well. The ability to rapidly zoom and inspect information within a 3D, aerial image-rich, spatial context makes Google Earth a powerful tool for soil scientists.

Topic Area: *Updating & Expanding Soil Survey Operations*

M-16
Soil Survey Region 4: Soils of the Rocky Mountains
Eva Muller, NRCS

Soil Survey Region 4 covers the Rocky Mountain region and includes parts of eight states; Colorado, Idaho, Montana, New Mexico, Oregon, Washington, Wyoming, and Utah. The regional office is located in Bozeman, Montana and provides regional coordination, quality assurance, technical guidance and support, and technology transfer to nine Soil Survey Offices in the region. The majority of the offices in the region are involved in initial soil mapping projects and ecological site development, but other focuses include Soil Data Join and Recorrelation and MLRA updates. Like other regions in the western US, Region 4 contains large amounts of public land and partners frequently with other federal agencies, including National Park Service, Forest Service, Bureau of Land Management, and Bureau of Indian Affairs. Some of the soil survey projects in Region 4 on public lands include Fossil Butte National Monument, Glacier National Park, Lewis and Clark National Forest, Caribou National Forest, Carson National Forest, and Ute-Ouray Indian Reservation.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-17
A Soil Health Partnership with an Emphasis on Rangelands and Forestlands of the Intermountain West
Douglas Merkler, USDA-NRCS; *Rose M. Shillito*, Desert Research Institute; *James Hurja*, USFS; *Mandy Willams*, SWCA-UNLV

NRCS in Region 2 and Region 8 are developing a Soil Health Partnership with USFS, BLM, USFWS and the Desert Research Institute to measure and communicate the economic and environmental benefits of different soil management strategies and provide a set of regionally specific, data-driven recommendations that managers can use to improve the productivity and sustainability of our Rangeland, Forest and Agricultural lands. Using a standard protocol developed primarily for Agricultural lands in addition to more rigorous observations of infiltration, hydrophobicity, microbial ecology, and soil structure we compare paired disturbed and undisturbed sites in several different biogeographic zones within the Intermountain Region. As an entry point in our understanding of soil health, any measured soil constraint can be taken as a management target. When multiple constraints are considered together, a management plan can be developed to restore functionality to the soil. Effective users of the soil health information will realize that implementation of a single practice can affect more than one indicator and benefit multiple soil functional processes in disturbed sites and help to improve sustainability and restoration of disturbed systems.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-18
Building Partnerships in Soil Survey Region 8
Cathy McGuire, USDA-NRCS-SSR8

Southwest Region 8 poster will highlight recent work with partners to complete soil surveys. Region 8 staff have completed four National Park Service soil surveys in the last two years. This includes Capitol Reef, Sunset Volcano, Walnut Canyon and Wupatki National Parks. White Sands and Carlsbad National Parks are currently being correlated and should be published this year. Mohave

Preserve and Zion National Park are actively being mapped. Most of the Parks have become their own soil survey areas, are SSURGO certified and have complete manuscripts on CDs. Soil Science Division priority is to map other federal lands. We have a reimbursable agreement with Bureau of Land Management (BLM) to map several of the grazing allotments in southwest Arizona. The BLM staff from their Yuma office assist our staff by collect data for ecological sites and participating in field reviews. We have had several successful collaborations between our offices both within and outside of the region. Technical teams have come together to coordinate and define MLRA and LRU boundaries and to complete update projects.In September we had our first face to face meeting of all Region 8 staff plus State Soil Scientists and Ecological Site Team Leader. The meeting included technical discussion and a field tour of riparian ecological sites in Zion National Park.

Topic Area: *Updating & Expanding Soil Survey Operations*

M-19
Year-Round Sustainable Vegetable Crop Production in 3 Mississippi Counties
Patrick Igbokwe, Alcorn State University; *Delaney Johnson*, USDA-NRCS

Intensifying vegetable production in time and/or space involves using the growing seasons and the land to their best advantage Mississippians who rely on fruits and vegetables produced for household food consumption (subsistence farmers) often go through cycles of relative abundance and scarcity. For these Mississippians the period immediately prior to harvest is a "hungry period." During these periods of scarcity, many families lack sufficient resources to meet their minimal nutritional needs and physical activities. This project to be conducted in farmer's field plots and different soil types in selected counties will be used to (1) determine the growth, yield and quality of fresh and processed vegetable crops produced in sustainable cropping system, (2) determine the impact of cover cropping on soil physical and chemical properties and soil microorganism populations, (3) investigate the economic significance of sustainable vegetable production in selected Mississippi counties.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-20
Haiti Pilot Soil Survey Initiative
Thomas Reinsch, Charles Kome, *Paul Reich*, and *Shawn McVey*, USDA-NRCS

USDA-NRCS collaborated with Haiti Ministry of Agriculture, Natural Resources, and Rural Development (MARNDR) and Faculty of Agriculture and Veterinary Medicine (FAMV) to initiated a pilot soil survey of 3,000 Ha to build capacity and establish partnerships in order to collect, organize, and disseminatate soil information. The initiative aims to enhance agriculture productivity, promote sustainable land use and improve short and long term socioeconomic and environmental condition. Preliminary assessment of capabilities and resources was conducted in 2012. A stakeholders meeting to identify partners, available resources, and expected outcomes was held in 2012. A Cochran Fellowship Study Tour consisting of three phases was held in 2013. Phase I included a two day working session with National Leaders at the USDA/NRCS National He Topic: Enhancing, Promoting & Supporting Soil Dataadquarters in DC; Phase II involved a week-long combined session for both the Haitian Leaders and Specialists and Phase III was an additional week of in-depth training for the Haiti GIS, Database and Laboratory Specialists. A conceptial prelimnary soil map has been created using digital soil mapping techniques. Representative sampling sites have been identified. Capacity building through field work and lab characterization was completed in 2014. Funded by USAID and coordinated by USDA Foreign Agriculture Service.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-21
Soil Survey Field Methods and Soil Interpretations Outreach to Chilean Soil Survey
Susan Southard, USDA-NRCS; *Randal Southard* and *Felipe Andres Aburto Guerrero*, University of Concepcion, Chile

The outreach focus was to help teach a class for natural resource professionals in soil survey field methods. The class used standards provided in the USDA-NRCS Field Book to Describing Soils, and the USDA-NRCS Keys to Soil Taxonomy, both of which were also provided in Spanish. Additional references included the National Soil Survey Handbook (NSSH) 1993 Soil Rating Guides and the NRCS Lab Methods Manual. The class was modeled after a field methods class that has been taught at the University of California-Davis for over 75 years. Chile does not have soil maps of areas outside the central valley, so each site outside of the valley was a new discovery for instructors and students as well. At each site students learned field methods such as texturing, measuring and recording soil and site properties, observing and making a soil description. They also classified the soils, and identified important interpretive features of the soils and their impacts on different land uses. Sites included transect points from the Concepcion coast to Malalcahuello Preserve in the Andes to the east. Once at the preserve, the students mapped a small area using transects and

compiled a map over 4 days of field work. A final soil map was prepared and contrasting soils observed during the week were rated for different uses using interpretive criteria developed by the National Cooperative Soil Survey. Instructors noted many similarities with the soils of California and those observed in Chile and soil climate regimes used in Soil Taxonomy fit well within the mapping climosequence.

Topic Area: *Updating & Expanding Soil Survey Operations*

M-22
Soil Survey Region 2 – The Pacific Region – Innovative Activities
Cynthia Stiles, *Dylan Beaudette*, *Ed Tallyn*, and *Jennifer Wood,* USDA-NRCS

The Pacific Soil Survey Region encompasses most of California, Nevada, all U.S. Pacific Islands and southern Oregon. There are nine MLRA Soil Survey offices performing not only the 'traditional' activities of soil survey (SDJR, MLRA Update, and remaining initial soil mapping efforts) but also striving to provide innovative technologies and methods to improve our soil survey informational process. Some of the tools currently under development include:

- MRLA / LRU Database Prototype: A new approach to defining MLRA, LRU, and ESD univariate concepts using more robust multivariate signatures, based on existing delineations and field observations. This database of signatures is constantly updated as concepts change and supports mapping of MLRA, LRU, and eventually ESD, concepts though supervised classification.
- 'Henry' Soil Climate DB and Related MAST Models: This effort will provide a new platform to keep track of the copious and varied soil climate data collected as part of historic mapping, current monitoring, and ad hoc installations to support special projects. Outputs from the database can be used to construct regional models of MAST already being implemented in regional initial and update surveys.
- DSM Activities for Initial Mapping in Access-Restricted Areas: A variety of digital soil mapping techniques are being successfully used to support initial mapping in Sequoia / Kings Canyon National Park.
- Guidelines for Mapping Soils in Urban Settings: Using expert knowledge from our field mappers "in the city", our regional staff is developing new helpful guidelines for urban soil mapping efforts, helpful in our efforts to capture all soils.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-23
Seasonal Saturation in Loamy Soils in the Lower Mississippi Valley
Edgar Mersiovsky, USDA-NRCS; *Larry West*, Soil Survey Research and Laboratory, USDA-NRCS National Soil Survey Center; *Kristopher Brye*, Professor of Applied Soil Physics/Pedology

Some loamy soils in MLRA 131A, Southern Mississippi River Alluvium, are interpreted with a seasonal water table between 0.4 and 1.1 m during the winter/spring wet season. Agricultural practices, however, have been reported to have lowered the alluvial aquifer in the region that is assumed to be the source of the SWT in these soils. Thus, this study was initiated with the objective to evaluate seasonal water table depths for loamy soils, initially the Dundee series and currently the Commerce series and associated landforms throughout the Lower Mississippi Valley. Sites from northeast Arkansas to south Louisiana were instrumented with piezometers to monitor water table heights for periods ranging from 24 to 58 months with assistance from MRLA SSO staffs in Milan, TN, Metcalfe, MS and Denham Springs, LA. Soils were described to depths up to 5 m to evaluate relationships between morphology of horizons and depth of seasonal soil saturation. IRIS tubes were installed at each Dundee site for one season to evaluate Fe reduction in near surface horizons. Data for Dundee sites indicate that SWT are deeper than currently interpreted for the Dundee soil, NRCS should consider establishing a drained phase for Dundee map units in MLRA 131A. Application of the drained phase to current map units should be at the discretion of local soil scientists since data from this study are aerially limited and portions of Dundee landscapes may have seasonal water tables that support current interpretations for Dundee. Data at the Commerce sites are currently being evaluated.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-24

Revision of Interpreting Indicators of Rangeland Health Indicators for Wet Herbaceous Ecosystems

D Charles Stemmans II, USDA-NRCS

Coastal marsh ecological sites are characterized by a suite of environmental and biological parameters that are not well described in the current indicators of the Rangeland Health Assessment Protocol. This provides information for the consideration in the definitions or the development of a specific manual describing the 17 Indicators utilized in the Rangeland Health Assessment Protocol. A Rangeland Health Reference sheet is required as a minimum for approved an Ecological Site Description (ESD), in which the reference community phase is classified as rangeland (USDA, NRCS 2014). By definition marsh ecosystems are rangeland (Pellant, Shaver, Pyke & Herrick. 2005) and therefore require Rangeland Health Reference sheets to reach the approved status. The Rangeland Health Reference Sheet provides vital information about the quality of a site as well as reference conditions specific to that site. The current definitions of indicators within Interpreting Indicators of Rangeland Health (IIRH) are specific to upland range ecosystems. Marsh ecosystems are unique due to the continuous or almost continuous inundation or saturation of the soil surface which affects how some of the indicators are observed. To adequately represent and assess all rangeland systems, it is proposed that additional descriptions of indicators, characteristic of wet herbaceous ecosystems, be considered for inclusion in the accepted rangeland health protocols or development of a specific manual. The intent of this is to provide a framework to not re-define the indicators but provide additional guidance when the indicators or utilized to assess a wet herbaceous ecosystem.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-25

The Complexity of the STM's in Coastal Marsh Ecosystems: A Look at the Fresh Fluid Ecological Site STM (You're not in Kansas Anymore!)

D Charles Stemmans II, USDA-NRCS

Coastal marsh ecological sites are dynamic systems that can change greatly and rapidly. Hydrologic factors that influence these sites include the volume, energy, and duration of water entering and flowing through the system. An additional factor that directly influences community composition and ecological function is salinity. Plant composition of coastal marshes are often complex; the result of colonization by both native, non-native and invasive species. Further complications of these systems result from direct (on-site) and indirect (off-site) anthropogenic impacts, which can greatly alter successional pathways of marsh communities. Capturing and representing the dynamics of and stressors to these systems in a block and arrow State and Transition Model (STM) is exceedingly complicated and oversimplifications often result. The Fresh Fluid Marsh Ecological Site consists of at least six vegetation states. The Reference State is characterized by expanses dominated by maidencane (Panicum hemitomon). Depending on local hydrodynamics and salinity gradients, several alternative plant community states may develop. As an example of the site's dynamics, local areas of the Open Water State with high energy hydrodynamics often become a zone of sediment deposition, which can lead to the development of an emergent marsh in less than 15 years. Conversely, low energy hydrodynamics in the Open Water state transport few sediments and may never lead to an emergent marsh. Intertwined in this dynamic interplay of flow dynamics, sediment transport, salinity gradients and organic soil thickness development are suites of plant communities with varying tolerances and the very foundation of the marsh ecosystem: deltaic formation.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-26

Soil Systems of the Boundary Waters Canoe Area Wilderness

Larissa Schmitt and *Danielle Evans,* NRCS

The Boundary Waters Canoe Area Wilderness (BWCAW) is located in northern Minnesota and is approximately 1.1 million acres. Managed by the USFS, the BWCAW is a remote area that has only partially been soil mapped in the past. In 2013 and 2014 the NRCS and USFS collaborated on 2 field seasons and collected over 300 field soil investigations. This poster describes the soil classes and parent materials of the BWCAW. The four parent materials of this region are: Rainy lobe till, Lake Agassiz lacustrine sediments, outwash, and organics. In total, ten soil classes were derived from the four parent materials. This survey is the 2nd NRCS raster soil survey in the US intended to be a national pilot project to develop standards for producing raster-based soil survey products that meet national needs of the NCSS from remote sensing and digital soil mapping techniques.

Topic Area: *Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-27

The Importance of Ecological Site Descriptions (ESDs), How They Might Be Utilized, and Their Role in Conservation Planning

Michelle Clendenin, NRCS-Soil Survey

The importance of ecological site descriptions (ESDs), how they might be utilized, and their role in conservation planning. Ecological descriptions are the product of a nation-wide inventory and analysis of interacting factors of soils, vegetation and landscape characteristics. The heart of the ecological site concept is depicted in State and Transition models which illustrate relic, and successional vegetation trends, and provides the reader with interpretation on ways to manage and restore ecological communities. As an example, wildlife conservation may fall within one or more desired vegetation states, and is an example of how planners can be lead to specific program(s), and the conservation measures needed to achieve certain goals. Most importantly, the ESDs can be used to train resource professionals for delivery of sustainable resource management to the public. The potential users of ESDs include many conservation partners, such as federal, state governments, private consultants, academia, non-profit entities and landowners.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-28

Use of Visible and Near Infrared Spectroscopy (VNIRS) for Estimating Potentially Mineralizable Nitrogen

Subash Dahal, *Dorcas H. Franklin, Taylor Hendricks*, and *Miguel Cabrera,* University of Georgia

The fraction of total soil nitrogen that is mineralizable is important because it is that fraction which is most easily utilized by plants. The development of a fast and accurate method to determine potentially mineralizable nitrogen would be useful to improve fertilizer N recommendations in pastures. Nowadays VNIRS (Visible and Near Infrared Spectroscopy) is becoming popular for the estimation of different soil nutrients and has the potential to serve as a rapid and economical method of estimating mineralizable nitrogen in soil. The objective of this study is to evaluate the ability of VNIRS to estimate potentially mineralizable nitrogen in pasture soils of the Georgia Piedmont. Soil samples were taken at three soil depths (0-5 cm, 5-10 cm and 10-20 cm) from cattle camping areas and every 50 m within 10 pastures (7 to 17 ha). Spectral reflectance measurements of soil samples were recorded using Agrispec (ASDI Inc.) VNIRS (400 nm – 2500 nm) at the time of sampling. The consolidated samples were separated in two parts; one was air dried and another was refrigerated. Potentially mineralizable nitrogen was determined using hot-KCL and cold-KCL extraction method in air dried and refrigerated samples. Statistical analysis will be used to explore relationships between VNIR spectra and potentially mineralizable N.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications*

M-29

Progress on the Plains

John Warner and *Chad Remley*, USDA-NRCS

The Northern Great Plains Soil Survey office SSRO5 is located in Salina, KS. We are currently working on the Soil Data Join Re-correlation initiative (SDJR). Our region has completed over 50% of area mapped. Our region is fortunate enough to have 3 National Ecological Observatory Network (NEON) sites all in NE Kansas. Two sites are located on the Konza Prairie Biological Station (KPBS) in MLRA 76 Bluestem Hills. The KPBS is located in the Flint Hills which is the largest remaining area of uplowed tallgrass prairie in North America. The other site is located near Lawrence, Kansas at the University of Kansas biological research station in MLRA 106 Nebraska and Kansas Loess-Drift Hills. Ecological Site Descriptions (ESD) have become an important part of Soil Survey workload. Our region has 5 Ecological site specialist's working on updating ESD's in our region. One of the first approved ESD's in SSRO5 was the Upland Hills ecological site for the tallgrass prairies of the Flint Hills in MLRA 76. This poster will display the soil site characteristics and plant communities with their different states and transitions for the Upland Hills ecological site. Saturated Hydraulic Conductivity (KSAT) is one of the most important values used in the interpretations of soil data. In our region we have the ability to run 20 Amoozemeters at once to collect this information. The Soil Survey office in Lincoln, NE has run at least 5 repetitions at certain depths on 10 sites for the Burchard and Kennebec soils in MLRA 106 Nebraska and Kansas Loess-Drift Hills.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-30
Recent Developments and Projects in SS Region 10
Michael Whited, NRCS-SSD-R10; *Region 10 Staff*

As mandated by SSD-HQ. A R 10 update on activities, special projects, and accomplishments.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-31
Soil Systems of Region 10
Michael Whited, NRCS-SSD-R10; *Region 10 MLRA Offices*

A collage of soil systems diagrams from R 10. The use of soil systems diagrams are another way of education humans about soils and soil landscapes. We will present a collage of some of the Region 10 MLRA office submissions of Soil Systems diagrams.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-32
Effects of Tillage and Long-Term Irrigation on Dynamic Soil Properties and Taxonomy in Aridic Argiustolls of Western Kansas
Michelle Scarpace and *Dr. Michel Ransom*, Kansas State University; *Dr. Skye Wills,* USDA-NRCS National Soil Survey Center; *Dr. DeAnn Presley,* Kansas State University

Soil health and the classification of soils can be affected by humans in different agricultural practices. In western Kansas, most of the agricultural land is irrigated under strip tillage. This study will determine to how intense agricultural practices affects the classification and health of a soil. Soil health can be determined by measuring dynamic soil properties (DSPs). To understand how DSPs are affected by agriculture practices, nine sites in Sheridan County, Kansas mapped as Keith (fine-silty, mixed, superactive, mesic Aridic Argiustolls) will be described and sampled. Of the nine sites, five are under strip till, and four have been under no-till management ranging from four years to fifteen years. All sites have been irrigated under center pivot systems since the 1970's. Soil samples of the A horizon were taken at each site to analyze total carbon, aggregate stability, bulk density, pH, soil microbiology, and particle size distribution. We hypothesize that the established (longer than 10 years) no-till sites will have better soil health with higher carbon levels, aggregate stability and biological activity. Additionally, pedons were sampled from the strip till sites in the irrigated areas as well as outside the pivot track to represent dryland conditions. The micromorphology of thin-sections and the pedon descriptions will be analyzed to determine if the classification of Keith is affected by agriculture management. We hypothesize that argillic horizons in Keith formed through a combination of clay illuviation and the in-situ weathering of mica where the weathering and clay illuviation were accelerated by long-term irrigation.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-33
Identifying Problematic Red Parent Material Soils in the United States
Sara Mack and *Martin Rabenhorst* University of Maryland College Park

Section 404 of the Clean Water Act requires delineation of hydric soils as one of the three parameters for wetland protection and preservation in the United States. Certain red soils derived from "red parent materials (RPM)" present particular problems for recognizing hydric soils due to their inherent resistance to develop typical redoximorphic features under saturated, wetland conditions. The National Technical Committee for Hydric Soils' (NTCHS) Field Indicator, F21 Red Parent Material, is currently an indicator approved for hydric soil testing in all MLRAs; however, not all red soils are resistant to developing typical hydric soil morphology and thus, misuse of the indicator may lead to erroneous hydric soil (and wetland) delineations. The Color Change Propensity Index (CPPI) analysis has also been developed to evaluate whether or not red soils should be considered as problematic RPM so that indicator F21 can be used to identify hydric soils in these situations. The objectives of this project are to identify and analyze potential RPM soils from across the nation (using CCPI technology), and to relate these results with soil and geological map unit data (e.g. STATSGO, SSURGO, etc.) in order to develop guidance maps for the occurrence of the problematic RPM nationwide. Methods and strategies of the study will be presented and information regarding participation in the project will be available.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications, Updating & Expanding Soil Survey Operations*

M-34

Integrating Soil Microbial Community Composition into Soil Survey as an Index to Soil Health

David Myrold, Oregon State University; *Ron Raney*, *Cory Owens* and *Kyle Stevens*, NRCS

The importance of soil microorganisms in the functioning of soils is widely acknowledged and recent advances in methodology now allow the immense diversity of bacteria and fungi in soil to be cataloged. The objective of this collaborative project is to integrate measurements of the soil microbial community (abundance and compositional diversity of bacteria and of fungi) with existing soil physical and chemical data for soils in Oregon that have been mapped by the NRCS. More than 100 soils from throughout Oregon have been identified and will be analyzed, allowing the creation of a first-generation spatiotemporal map of soil microbes and to relate the microbial information to soil health assessments.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-35

Soil Survey Region 11 Activities

Tonie Endres, USDA-NRCS

The East Central Glaciated Soil Survey Region (SSR 11) has eleven MLRA Soil Survey Offices (SSO). The initial soil survey is completed in all parts of the Region. Major soil survey activities in SSR 11 include ecological site development, soil data harmonization, and providing technical assistance to States. Field work has been limited the past couple of years due to a focus on soil data harmonization as part of the Soil Data Join Recorrelation (SDJR) Initiative. However, most MLRA SSOs continue to spend some time in the field to collect data on dynamic soil properties, water table levels, and saturated hydraulic conductivity (Ksat), or to sample soils for soil health analysis or for full characterization analysis of benchmark soils. As work for the SDJR Initiative winds down, more time will be spent collecting this kind of field data. Specific needs for future soil survey projects are being identified and documented as part of the SDJR Initiative. Among these include developing ecological site descriptions in areas dominantly used for row crops; providing additional soil property data and soil interpretations in urban areas; running transects to determine map unit composition; and analysis of soil properties across catenas or landforms. Revisions needed to spatial datasets are also being identified.

Topic Area: *Updating & Expanding Soil Survey Operations*

M-36

Penetrometer-Mounted VisNIR Spectroscopy: A Practical System for Field Implementation

Cristine Morgan and *Jason Ackerman*, Texas A&M University; *Yufeng Ge*, University of Nebraska

Visible, near inferred (VisNIR) spectroscopy has become a common technique for measuring soil properties of dried and ground laboratory soil samples. Recently, technologies have emerged to allow for the rapid collection of VisNIR spectra in the field. Soil scientists have lauded these in situ VisNIR sensors as important tools for on-the go soil sensing; however, the application of such sensors has been limited. Two challenges have been to miniaturize the system for practical field use and development of techniques to use field-collected VNIR spectra with dried-ground VNIR libraries. For VisNIR to be field applicable, the light and optical system was reconfigured to be mounted in a soil penetrometer with a 3.15-cm outer diameter. The penetrometer is small enough to be used in high-clay soils and clay pans and gives a signal with a high signal-to-noise-ratio. In this study we demonstrate the application of dry-ground spectral libraries to prediction of soil properties from in situ VisNIR. In situ VisNIR spectra were collected using a penetrometer mounted spectrometer. Soil properties (e.g. clay and organic carbon content) were then predicted using the in situ VisNIR spectra and an existing dry-ground spectral library. Results show that the preexisting library can successfully predict in situ soil properties with accuracy comparable to that of predictions made on VisNIR spectra collected on laboratory samples.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-37

Measuring Changes in Dynamic Soil Properties in Dryland and Irrigated Soils Under Different Cropland Management Practices

Chad Remley and *Skye Wills*, USDA-NRCS

In January 2015, the Governor of Kansas set forth a long term vision for the future of water supply in Kansas. In the document, it was noted that the Ogallala aquifer has been over appropriated and may only have 50 years or less of water withdrawal from the aquifer. Improving soil health of irrigated cropland is one means of conserving water and extending the useable life of the aquifer. In the fall of 2014, the Natural Resources Conservation Service (NRCS) Kansas soils staff began working with staff from the National Soil Survey Center and Kansas State University in reviewing changes in Dynamic Soil Properties (DSP) of irrigated cropland. Four sites

are located on Keith silt loam, 0 to 1 percent slopes under strip tillage, long and short term no-till and no-till with cover crops management practices. Soil survey characterization, dynamic soil properties and soil health assessment techniques will be used on all sites in both irrigated and dryland areas. Management practices influence the water storage availability and infiltration rate of the soil. Producers are interested in knowing what soil properties are changing and how fast they can change using different management practices. The DSP sampling is important in identifying measurable soil properties that relate to changes in irrigated cropland management practices.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-38

Evaluating the Relation of Soil Microbial Diversity and Soil Health in Vegetable Production Systems with Cover Crops

William Kingery and *Shankar Shanmugam*, and *Jayani Wewalwela,* Mississippi State University; *Delaney Johnson,* NRCS

Soil health is holistic. It is connected through the interactions of physical, chemical and biological properties and processes within a soil ecosystem. Soil microorganisms, primarily bacteria and fungi, are directly involved in decomposition of the organic matter from root exudates and plant residues, and in symbiotic processes related to nutrient acquisition by the plant. Thus, the quality and quantity of carbon compounds entering the soil are significantly influenced by plant-microbe feedbacks. Therefore, soil microbial biodiversity can be an indicator of a healthy soil, and a baseline for sustainability measure that can be established by correlation with soil health parameters and yield. We will present the current state of knowledge with respect to microbial diversity and soil health. The first phases of a long-range effort to evaluate microbial diversity and soil health in vegetable production systems with cover crop components will also be presented.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

M-39

DSP and Ksat Investigation of the Benchmark Catena of MLRA 102C - Loess Uplands

Daniel Shurtliff, *Grant Jackson, Phillip Schoeneberger*, and *Cathy Seybold*, USDA-NRCS

In 2014, the Nebraska NRCS State Office, in partnership with the MLRA 102C and MLRA 106 Soil Survey Offices, initiated an investigation of the Saturated Hydrologic Conductivity (Ksat) and Dynamic Soil Properties (DSP) of a benchmark catena within the 102C Loess Uplands MLRA. The soil series being investigated in this study represent over 50 percent of the acreage of the MLRA. The study includes gathering Amoozemeter Ksat data of the Soil Profile to a depth of 150 cm, and surface soil property data of the Catena soils under long term pasture and under a corn-soybean no till/mulch till rotation. This tillage treatment is the most commonly applied in this MLRA. The loess soils within this MLRA naturally contain between 25 and 30 percent clay. This clay content range straddles the transition limits of many engineering and agronomic interpretations, as currently derived. The data gathered during this multi-year project will be valuable for accurate prediction and NASIS database population of the range and representative value of the organic matter, bulk density and saturated hydrologic conductivity of these soils under different land uses. It will assist greatly in interpreting these soils correctly for engineering and agronomic uses. Participants in the field investigations: From NRCS Nebraska: Daniel Shurtliff, Patrick Cowsert, Neil Domini and Nathan Thompson; From NSSC and KSSL: Phil Schoeneberger, Cathy Seybold and Skye Wills; From SS Region 10: Grant Jackson; From SS Region 5: Bruce Evans and Casey Latta.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-40

Phosphorus Desorption Characteristics and Relationships of U.S. Soils

Rebecca Young and *Mark Kuzila*, University of Nebraska-Lincoln, School of Natural Resources; *Candiss Williams* and *Michael Robotham*, USDA-NRCS

Eutrophication and the contaminating of surface waters with phosphorus (P) is a major environmental issue throughout the United States. In many cases, sediment attributed to runoff and erosion from agricultural lands has been noted as a source of the P degrading waters. However, in order to improve P management at the watershed and farm and field scales, more information is needed on the behavior of P in soil. Thus, the objective of this research is to evaluate P sorption and desorption for a range of soils in the U.S. to develop better estimates of their potential to contribute P to surface waters. Key aspects to this study during the first year have revolved around the development of desorption curves and their relationships to the physical characteristics of the soils. The double-point anion exchange resin extraction method was used to measure desorption on surface horizons from 292 of the most common agricultural soils in the U.S., and the results have been compared to the clay content, carbon content, calcium carbonate content, pH, acid ammonium oxalate extractible aluminum and iron contents, Mehlich-3 P, and oxalate P characteristics

of these soils. This presentation will summarize these results, discuss the correlations between total P fixation capacity and other soil properties, and summarize the development of P-loading potential predictive functions and P-behavior interpretive groups of soils.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-41
Improved Rectification of the Soil Survey
Martin Rosek, Bernie Skipper, and *Mark Roloff*, USDA-NRCS

The soil maps that are published on Web Soil Survey (WSS) should be at least as accurate as the hard copy soil maps that were published 50 years ago. During the SSURGO initiative, many of the soil surveys were manually recompiled to the USGS topographic base maps due to lack of available digital ortho. Because of this, most of these surveys have areas of poorly rectified soil lines. The atlas sheets from the published soil were used to evaluate the placement of the soil boundaries of these soil surveys. The digital version of the soil survey published on WSS is the 'Official' soil survey. This has important legal implications (e.g. Preliminary Technical Determination (PTD) of Wetland and HEL Delineations uses Web Soil Survey). Because SDJR is a priority for the MLRA office staff, the spatial data evaluation of these surveys has not often been addressed. With the SSURGO initiative ending, the Digitizing Unit staff can provide the expertise and time to accomplish this task. The source materials for this process include a scan of the atlas sheet from the soil survey, the scan of the contact print that was used for publication, DEM and DOQ for the soil survey area. Using either the ERDAS IMAGINE or OrthoMapper software, the scan of the atlas sheet is ortho-rectified to the DOQ. The SSURGO data is then adjusted to match the rectified atlas sheet using the Spatial Adjust Tool in ArcMap.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

M-81
Region 9
Ann Kinney, USDA-NRCS

The Southern Great Plains Soil Survey Region 9 Office, located in Temple, Texas, provides quality assurance for soil surveys and ecological sites for most of Texas and parts of Arkansas, Colorado, Kansas, Louisiana, New Mexico, and Oklahoma. Region 9 has 13 MLRA Soil Survey Offices – 8 located in Texas, 3 in Oklahoma, 1 in Arkansas, and 1 in Louisiana. The initial soil survey is completed in all parts of the Region. Major soil survey activities in Region 9 include Soil Data Join Recorrelation (SDJR) initiative, ecological site development, and providing technical assistance to States. The main focus for the Region 9 staff is the SDJR initiative. Soils staff assisted with SCAN Site installations -- sampling the soils, setting up the sites, and installing soil temperature and moisture sensors. Soils staff supported various High School, and Collegiate Soil Judging Contests and the National Land and Range Judging Contest by organizing the contests, as well as preparation and set-up of the pit sites. Population of Ecological Site Information System (ESIS) continues to move forward and the Provisional Ecological Sites selected for completion in Region 9 for Fiscal Year 2015 are MLRA 82A, Texas Central Basin; MLRA 84A, North Cross Timbers; and MLRA 152B, Western Gulf Coast Flatwoods.

Topic Area: *Updating & Expanding Soil Survey Operations*

M-82
Collaborations between NatureServe and NRCS in the development of ESDs
Shannon Menard, NatureServe; *Stacey Clark* and *Nels Barrett,* NRCS; *Judy Teague,* NatureServe

NatureServe and NRCS have developed several initial collaborations to link NatureServe's National Vegetation Data Standards with the development of Ecological Sites (ES) and Ecological Site Descriptions (ESD) in the eastern US. NRCS Soil Science Division efforts are intended: (1) to improve the geospatial content of the National Soil Survey and (2) to standardize and extend the ES and ESD nationwide, as an extension of the soil survey. NatureServe and NRCS collaborations under way in the Eastern and Midwestern US incorporate NatureServe's "Core Methodology", in particular, information from the National Vegetation Classification and Ecological Systems Classification into ESD development. The national priority for ESD development has re-focused on a seamless national coverage of preliminary Ecological Sites and "Provisional ESDs" that require a vegetation/plant community component for each draft State-and-transition model to characterize site dynamics. NatureServe has extensive experience in developing ecological community development both nationally and internationally. ESD development would be greatly enhanced by a strong collaboration between NatureServe and NRCS Soils Science Division. In addition, data from NRCS ESD work would refine US National Vegetation Classification in regions where there is this type of collaboration. Pilot work in the Midwest, Northeastern, and Southeastern US has demonstrated the potential of this relationship.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

Tuesday Posters

T-41

Compiling Soil Legacy Data for Digital Soil Mapping in Chile

Luis Reyes-Rojas and *Alfred Hartemink,* Department of Soil Science, University of Wisconsin-Madison

Legacy soil surveys are the only official source of soil information in many countries. In Chile, the Chilean Natural Resources Information Center (CIREN) is the official repository institution of soil surveys. About 65% of the country has been covered by soil surveys, but within some 23% (176,660.35 km2) has been mapped with scales of 1:20,000 to 1:500,000 in remote areas. CIREN had several reports with the series representative pedons organized by 15 administrative divisions. In this study, we used 9 of the 11 available soils surveys and they contained 662 pedons with description and physical-chemical soil properties. All data were extracted from the reports and the data were standardized using the same names and units for each soil property. Several pedons were not georeferenced and a total of 536 pedons are with a UTM position including soil properties such as particle size (% of sand, silt and clay), bulk density, water content at field capacity and wilting point, organic carbon, pH in water, extractable cations and CEC. All pedons have been classified in Soil Taxonomy to the family level. The database will be used to produce fine resolution digital soil maps for a range of properties.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications*

T-42

Trend Analysis of Key Dynamic Soil Properties in a California Prune Orchard

James Komar, USDA-NRCS

To meet current-day needs, the static soil properties characterized by soil surveys must be joined with an understanding of how soil properties change under various uses and management in order to effectively meet the dual goals of sustained productivity and soil function. Land preparation and management practices in northern California fruit orchards alter critical soil properties and functioning, disrupting water, air, nutrient, and carbon cycles. Outcomes include accelerated soil erosion and runoff, off-site delivery of nutrients and chemicals, increased production costs, and reduced soil productivity. Initiated in 2014, this project evaluates trends in select near-surface dynamic soil properties, soil hydraulics, and nutrient supply upon application of three commonly used orchard floor management scenarios. Unique elements examined in this work include an evaluation of the Soil Health Nutrient Tool (Haney Test), and the Ohio State University Enzyme Test (under development). This work adds support and context to the recommendations NRCS field offices give our cooperating Producers when planning to address critical resource concerns. More broadly, this work aids in the establishment of protocols for cataloging dynamic soil properties, furthering our ability to predict the effects of management on critical soil functions.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Evolving Vision for Ecological Sites & Soil Health*

T-43

Supplemental Mapping of the Francis Marion National Forest

Greg Taylor, Region 3 Soil Survey Office – NRCS; *Charles Lagoueyte*, NRCS MLRA Soil Survey Office

This project stemmed from a conversation between an ES Specialist and Soil Scientist with the USFS. While reviewing several ES descriptions the soil scientist asked if soils was considered in their parameters. The ESS responded "no, because the soil survey is too broad and not detailed enough to give them the data they need". The USFS contacted us to see what we could do. The plan and results will be covered in the presentation.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Updating & Expanding Soil Survey Operations*

T-44

Soil Health as an Ecosystem Service

Jodie Reisner, NRCS & Graduate Student University of Missouri

Soil Health as an Ecosystem Service (Literature Review) Soil Health is becoming an institutional word across the U.S. and global landscape. Most soils professionals and conservationists know the meaning of a living and functional soil. The living, functional soil

can provide many ecosystem services. A soil that is covered most of the year can provide a stabilized soil surface which results in reduced soil erosion, agrochemical transport, nutrient transport, and reduced overland flow of water. The water hydrologic cycle can function with greater resiliency and capability. This is due to the fact that greater infiltration at the soil surface increases subsurface flow for plants and soil organisms, deep percolation for groundwater recharge and movement to surface waters. Water quality can be improved with a healthy functioning soil. A healthy functioning soil can accumulate soil organic carbon in the upper horizons to mitigate carbon dioxide reductions needed in the atmosphere. Soil can be a sink for greenhouse gases. Increasing carbon in the soil can also increase nutrient pools for plant growth. The biological components of a diverse healthy soil can work in synergy to accomplish much for the biota in the soil ecosystem and the plant communities it supports. The ecosystem services that a healthy soil can provide can be grouped into regulating, provisional, and cultural services. Measuring these ecosystem services and tying them to the National Cooperative Soil survey would be a needed addition of information shared through the soil survey.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

T-46

Provisional Ecological Site Legend: Initial Bridge between Soil Survey and Vegetation Communities in the Carolina and Georgia Sand Hills Major Land Resource Area (MLRA 137)

Debbie Anderson, *Dee Pederson,* and *Greg Taylor*, USDA-NRCS

The Carolina and Georgia Sand Hills (MLRA 137) is composed of droughty Quartzipsamments on uplands, loamy and fine-loamy soils in dissected areas of the landscape, and blackwater swamps in drainageways. The diverse landscape yields wide ranging soil types and substantially different vegetative communities. Soil map unit components are the basis for the development of provisional ecological sites. Ecological sites were correlated to soil map unit components to produce a Provisional Ecological Site legend for MLRA 137. All soil map units associated with the MLRA were grouped based on soil properties and landscape factors. Natural vegetation communities were identified based on literature review, existing data analysis, field reconnaissance, and expert knowledge. These communities were then correlated to soil map unit components, resulting in a Provisional Ecological Site legend for the entire MLRA. Fourteen provisional ecological sites were identified. This legend will be updated and refined as detailed projects are conducted on each potential ecological site. These provisional ecological sites may be further separated or combined based on other factors such as climate or site productivity as the ecological site descriptions move toward the Approved status.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

T-47

Progress on Ecological Site Descriptions in Iowa

Thomas Rosburg, Drake University; *Rick Bednarek* and *Stacey Clark*, USDA-NRCS

The Natural Resources Conservation Service in Iowa and Drake University in Des Moines Iowa formed a partnership in 2014 to collect field data on Ecological Site Descriptions (ESD). Drake faculty and contractors were in the field conducting vegetation and soil research from June 17 to August 18. Two field teams, each with a highly experienced botanist, surveyed sites that represent the best examples of Iowa's native ecosystems. Drake students were employed to process biomass samples and enter data. Vegetation and soil surveys were completed for 41 ESD plots representing 5 different MLRA regions and 32 different soils. Prairie ecosystems were most represented with 20 plots, followed by wetlands with 15 and forests with 6 plots. Approximately 3,370 cover and biomass measurements were made for plant species observed in the herbaceous layer for all plots. A NRCS soil scientist from Iowa completed soil descriptions for a representative soil profile from each plot. The field soil series determination differed from the mapped soil for 13 of the 41 plots. In addition, NRCS SSO offices have created draft Ecological Site-Soil correlation legends to provide a framework and context for the data collected and for future work. These draft site concepts will be part of the Provisional Ecological Site Initiative, and will be further tested and refined through future field work and reconnaissance. An overview of the methodology and the initial findings of the research completed in 2014 will be presented, as well as the plan for future work in 2015.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

T-48

Expressing the Central Concept of Soil Using Visual Plots

Kevin Godsey, NRCS

The component table in NASIS is part of an 'estimated soil properties database' and not a lab data "database". The component data is a conceptual construct developed from aggregated values based on laboratory data and tacit knowledge. When lab data is scarce or absent we must use estimated values. This paper will introduce you to a visualization process that will allow you to estimate

plausible ranges in order to better represent a component concept. I believe the ranges of sand, silt and clay are more informative about a soil then the RV value. Two soil horizons could have nearly the same RV value of silt loam yet one has a narrow range that does not go beyond the silt loam textural class while the other may span four different classes. These ranges can be more predictive of the soils response then the RV value alone.

Topic Area: *Updating & Expanding Soil Survey Operations*

T-49
Soil Climate Analysis Network (SCAN)
Mike Strobel and *Deb Harms*, USDA-NRCS

The Soil Climate Analysis Network (SCAN) is a comprehensive, nationwide soil moisture and climate information system designed to provide data to support natural resource assessments and conservation activities. Administered by the United States Department of Agriculture Natural Resources Conservation Service (NRCS) through the National Water and Climate Center (NWCC), in cooperation with the NRCS National Soil Survey Center, the system focuses on agricultural areas of the U.S. monitoring soil temperature and soil moisture content at several depths, soil water level, air temperature, relative humidity, solar radiation, wind, precipitation, barometric pressure, and more. Sites operate in cooperation with Federal, State, local, and tribal entities. There currently are more than 240 stations in 39 States and an ever-growing list of requests for new sites across the nation.

Topic Area: *Updating & Expanding Soil Survey Operations*

T-50
Overview of the Fundamental Changes in Soil Taxonomy Task Force
Brian Needelman, University of Maryland*; Mark Solt,* University of Rhode Island

The Soil Science Society of America has created a Task Force to develop and facilitate the implementation of fundamental changes of Soil Taxonomy. These changes are intended to decrease the complexity and increase the ease of use of Soil Taxonomy such that it can and will be used by more than experienced pedologists. In this presentation, we will discuss the background, rationale, objectives, guiding principles, and current activities of this task force including an update on active work on initial proposed changes. The guiding principles of the task force include solicitation of broad input from both the U.S. and international community, having minimal negative effects on existing National Cooperative Soil Survey mapping products, complementing concepts used in other soil taxonomic systems, and retention of knowledge embedded in the current system. We will also discuss how members of the National Cooperative Soil Survey can stay aware of and contribute to this effort. During the poster presentation, we will be soliciting input from conference attendees.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-51
Soil Survey Update Using the Knowledge Discoverer Module of ArcSIE
Jessica Philippe, USDA-NRCS; *Xun Shi,* Dartmouth College

Map updating is a primary task of NRCS for the foreseeable future. However, its content, procedure, and standard have been largely ad hoc. We conducted a pilot project to evaluate the potential of the Knowledge Discoverer (KD) module of the ArcSIE software in facilitating and regulating this practice. Rather than directly revising the polygon boundaries in an existing map, KD attempts to discover and improve the soil-landscape model underlying those polygons. To achieve that, KD takes polygons from an existing soil map and user-specified environmental data layers as inputs. It then builds and displays the relationships between the two in the form of function curves. The user can then evaluate and modify these relationships in both graphical and statistical ways. The updated relationships are then used by the ArcSIE's Inference Engine to create an updated map for the area. Our study area was a portion of the lodgment till areas in Essex County, VT, for which the original soil mapping was done in the 1980s using traditional methods, and the current SSURGO mapping was done with the ArcSIE initial mapping process (and thus the knowledge was explicitly available for comparing). The environmental data included wetness and slope derived from LiDAR-based DEM and USGS DEM. The pilot project demonstrates that an automated tool like KD has a great potential for integrating and standardizing the procedures and improving the efficiency and quality of map updating.

Topic Area: *Advancing Frontiers in Digital Soil Mapping/Information Applications*

T-52

The Distribution and Properties of V Horizons

Judith Turk, Stockton University; *Robert Graham,* University of California, Riverside

V horizons are a common type of surface horizon in arid and semi-arid lands that influence the infiltration and erosion processes. Our research has characterized the distribution and properties of V horizons using pre-existing data from NRCS databases and new data collected using X-ray computed tomography. V horizons are extensive throughout the Basin and Range Province of the western United States, covering an area of approximately 157,000 km2. Their maximum expression occurs within the Northern Basin and Range ecoregion, which experiences a colder, wetter climate, as well as a greater expanse of dry lake beds, which serve as a source of eolian parent material that influences V horizon formation. The structure of the V horizon often consist of columnar peds that part in the plates. The pore morphology of the V horizon consists of vesicles and vughs. The pores grow larger with increasing development, in a process that happens more rapidly along the top and sides of columnar peds. Interconnecting channels develop between vughs, connecting them primarily in the lateral direction, creating planes of weakness that become the faces of platy peds. Our results demonstrate the V horizons are extensive in area and have distinctive pore morphology that differentiates them of types of surface horizons.

Topic Area: *Evolving Vision for Ecological Sites & Soil Health*

T-53

Carbon Distribution in Selected Organic-Rich Soils of the California Delta

Philip Smith, Philip D. Smith, and *Kerry D. Arroues,* USDA-NRCS; *Michael A. Wilson,* USDA-NRCS, National Soil Survey Center; *Cynthia A. Stiles* and *Edwin F. Tallyn Jr.,* USDA-NRCS, Soil Survey Region 2 Office

The California Delta is an important and ecologically-sensitive agricultural area with over 97,000 hectares of farmland, producing diverse crops such as corn, asparagus, tomatoes, grapes, and stone fruit. Much of the land is below sea level and consists of a system of islands protected by levees. Degradation of the Delta's soils, especially its Histosols, is a major concern. In many areas, several meters of soil have been lost through the oxidation of organic matter (OM) as well as wind erosion.
As part of the USDA-NRCS' Bay Delta Initiative, the Hanford Soil Survey Office launched the MLRA 16 Bay Delta Soil Systems Study in 2012. The overall project objective is to provide a foundation of reliable field and laboratory data of major (benchmark) soils in the Delta. Data collected will be used to improve soil maps and interpretations, leading to improved conservation planning and preservation of these soils.
Objectives of this paper are to discuss characteristics of four selected pedons. Total carbon (C) as well as forms of OM (peat, muck) were evaluated with depth. Other data include rubbed and unrubbed fiber, pyrophosphate color, mineral content, and PSDA. Results from this study will be important to understand pedogenic differences between soils at different sites across the Delta. Also these data will document the form and stability of C, and provide better evaluation of C loss from agriculture land use in this area.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-55

Comparison of Soil Carbon Mapping Techniques Across the Hawaiian Islands

Michelle Lazaro, *Susan Crow*, *Creighton M. Litton, Paul Selmants, Mataia Reeves, Olivia S. Schubert,* and *Tomoaki Miura,* Department of Natural Resources and Environmental Management, University of Hawai'i at Manoa; *Cynthia Stiles,* USDA-NRCS, Pacific Region Soil Survey Office; *Christian Giardina,* USDA Forest Service, Institute of Pacific Islands Forestry; *Scott Turn* and *Shintaro Taniguchi,* Hawaii Natural Energy Instutute, University of Hawai'i Manoa; *Nicholas Koch,* Forest Solutions

Understanding the response of terrestrial ecosystem carbon (C) storage to changes in climate and land use change, requires accurate, spatially explicit resource assessments of C storage and an understanding of variation and sources of error. Here, two approaches to spatial projection of soil C storage were examined: (1) gSSURGO pre-summarized values and (2) kriging using a combination of the Kellogg Soil Survey Laboratory database and published literature values. A difference of 317.7% was found between approaches, highlighting the importance of establishing accurate assessments, especially in areas like Hawaii that have highly diverse soils and landscapes. The largest discrepancies between the approaches occurred in regions with sharp environmental gradients, low sampling densities, and contrasting land use. Since land use was identified as a key reason for large variation between models, differences in soil C stocks located in the district of Hamakua on Hawaii Island, with similar soils (i.e., all Hydruands; bulk densities from 0.23-0.46 g cm-3), that was previously managed as pasture and converted into a bioenergy plantation, were more closely examined. When C gains as a result of afforestation were calculated using the bulk density method, there was a reported gain of 17.5%, but only a 2.6% increase was observed when using the equivalent soil mass method. Thus, in easily compacted soils

that have the capacity to store large quantities of C, it is important to understand, correctly assess, and incorporate the mechanisms controlling soil C sequestration into baseline and future assessments to better guide policy and land management decisions.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-57

Saturated Hydraulic Conductivity in Loess Veneered Landscapes of the Shawnee Hills (MLRA 115 and 120)

Brad Lee, University of Kentucky; *Tanja Williamson*, USGS; *Philip Schoeneberger* and *Michael Wilson*, USDA-NRCS

Studies of saturated soil hydraulic conductivity (Ksat) across catenas are not abundant and have yielded conflicting results. The objective of this study was to evaluate Ksat across landscape positions (summit, shoulder, backslope, footslope, toeslope) and land use (managed grassland and forest) in soils with similar parent materials. Six catenas under grassland (3) and forested (3) land uses in Major Land Resource Areas 115 (Central Mississippi Valley Wooded Slopes) and 120 (Kentucky, Indiana Sandstone, Shale Hills and Valleys) were characterized and analyzed by particle size analysis and bulk density as part of the Shawnee Hills Project. Saturated soil hydraulic conductivity was determined in the field in their natural slope position using a compact constant head permeameter on selected soil horizons. These soil horizons included surface, top of argillic, fragipan (if present), and lower argillic. Ksat values of the surface and top of the argillic horizons were significantly different ($P < 0.02$) from all other horizons in the following order: Surface > Top of argillic > Fragipan = Lower argillic. There was no significant difference in Ksat between grassland and forest. These results suggest that soil horizon Ksat under grass and forest management in this region are similar, therefore hydrologic models utilizing soil Ksat measurements should incorporate variability in landscape position. However, these resultant interpretations of soil-water availability and movement can be extrapolated regionally in areas with similar land uses.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-58

Net Primary Productivity from a Soil Survey Perspective

Robert Dobos, *Sharon Waltman,* and *Steve Peaslee*, NRCS-NSSC

The amount of carbon a landscape can capture depends on several factors. First, the total amount of photosynthetically active radiation (PAR) an area receives determines a theoretical maximum. A second limiting factor is that while the PAR is present, there must be enough heat for photosynthesis to operate. The third limiting factor is that there must be water for plant growth. In an area of homogenous climate, the ability of the soil substrate to store and supply water and nutrients can vary markedly, which will impact the Net Primary Productivity (NPP) for that landscape. Thus, the soil acts as a choke: it cannot cause a portion of the landscape to greatly exceed the theoretical maximum, but the soil certainly can greatly reduce the amount of plant material a landscape can produce. A soil productivity index, including a climate term, is joined with gridded SSURGO (gSSURGO) to display NPP trends for the coterminous United States.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-59

Global Soil Partnership

Jon Hempel, National Soil Survey Center; *Thomas Reinsch,* and *Luis Hernandez,* Soil Science Division

The Global Soil Partnership (GSP) has been developed in response to the renewed recognition of the central role of soil resources as a basis for food security, climate change adaptation and mitigation, sustaining biodiversity and bioenergy production along, with provisioning of other key ecosystem services. Despite the role of the soil resource in these important environmental and societal activities, soil as a natural resource is still seen as a second-tier priority without an international governance body that can advocate for and coordinate initiatives to ensure that knowledge and recognition of soils are appropriately represented in global and regional dialogues and decision making processes. The GSP is a central body in the coordination of a strong partnership to maintain healthy soils required for feeding the growing population of the world and meeting their needs for biomass, fiber, fodder, and other products.The concept of the GSP is being been facilitated by the Food and Agriculture Organization (FAO) and has developed interactive, responsive and voluntary partnership that is open to governments, regional organizations, institutions and other stakeholders at various levels. Within this structure important partnerships are being developed.The GSP has developed five specific pillars of action that will support the process leading to the adoption of sustainable development goals for soils. These goals will contribute to environmental wellbeing of the soil resource through the prevention of soil erosion and degradation, reducing greenhouse gas emissions, promoting carbon sequestration and promoting sustainable use of agricultural inputs for soil health and ecosystems management. Work plans have been developed for all five pillars. Four of the five work plans were discussed and

approved for implementation by the Global Soil Partnership Plenary Assembly in July 2014. All Pillar work plans have had representation and input from the US. Of particular interest, Soil Taxonomy is recognized as a GSP supported system of soil classification within Pillar 5.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-61
Geographic Trends in Crop Productivity with Climate Change
Robert Dobos, *Steve Peaslee*, and *Sharon Waltman*, NRCS-NSSC

Changing climate will have an impact on where crops are grown and which crops are cultivated in an area. Commodity crops, such as corn, soybeans, winter wheat, and cotton are most productive where the climate and soils match best with the genetic adaptation of the crop. Predicting where the most productive climates for the various crops will exist and what soils will be present in those regions will allow better targeting of cultivar distribution and conservation efforts. To make these predictions, the National Commodity Crop Productivity Index (NCCPI) was modified to reflect 2 and 4 degree Celsius air temperature increases and a 2 degree decrease. When mean annual air temperature changes, the frost-free-days and growing degree days change as well. Precipitation patterns are predicted to also be altered in a changing climate. The model indicates a general northward and upward trend in the climatic optima for commodity crops having current genetics with warming.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-62
Soil Enzyme Analyses at the Kellogg Soil Survey Laboratory
Emily Hoehn, KSSL,UNL; *Diane Hooper*, KSSL; *Dan Snow*, UNL; *Faustin Iyamuremye*, KSSL

Soil enzymes are viewed as potentially important indicators of soil ecosystem health. The ability to assay soil enzymes is therefore of growing importance in the study of soil health. At the Kellogg Soil Survey Laboratory (KSSL), an alternative approach to conventional soil enzyme methods is being tested. This approach uses plate reader technology, and the system is equipped with an automated micro-pipetting system for accurate addition of multiple reagents. The plate reader approach is being increasingly used by the academic community, and the challenge at the KSSL is to streamline the method for potential production use. Current results are presented.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-63
Development of Global Soil Climate Maps Using the Java Newhall Simulation Model
Paul Reich and *Thomas Reinsch*, USDA-NRCS

New soil climate maps are presented based on data from the www.WorldClim.org and from the University of East Anglia Climate Research Unit (CRU). The WorldClim data consists of mean air temperature and precipitation for the period 1950-2000 (Hijmans et. al., 2005) on a 2.5 minute raster grid. The CRU data is for the period 1989-2009 (Harris et. Al., 2014) and is on a 30 minute grid. The Java Newhall Simulation Model version 1.6 (jNSM) (USDA-NRCS, 2011) was used to model soil moisture and temperature regimes from the two raster datasets. Resulting maps of soil moisture regimes and soil temperature regimes are compared with previously published maps that represent an earlier period (1960-1990). Detailed methodology are presented and advantages and disadvantages of each dataset highlighted. Recommendation of the most appropriate dataset will help us to move forward towards development of a new global soil regions map.The Global Soil Regions map (Soil Survey Staff, 1999) has been widely used as a reference by students and educators to understand the world distribution of Soil Taxonomy orders and suborders. An updated version of the map will be based on the Harmonized World Soil Database (HWSD) version 1.2 (FAO et al., 2012). The HWSD map improves on the original FAO World Soil map by incorporating larger scale maps for Europe, China and parts of Africa and Latin America. A conversion table was developed to provide the best approximate Soil Taxonomy class for each possible combination of soil moisture regime and FAO soil unit class. The resulting map will identify Soil Taxonomy orders and suborders (Soil Survey Staff, 2014).

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-64
Glaciated Soil Survey Region 12
Al Averill, USDA NRCS

Glaciated Soil Survey Region 12, as part of the National Cooperative Soil Survey program, provides technical leadership and support in the production, quality assurance, and delivery of scientifically based soil survey and ecological site inventory information throughout the northeastern United States from the Great Lakes to New England. The proposed poster will communicate soil survey activities within the region such as:

- Collaborative Subaqueous Soil Survey Work and Update Mapping of Tidal Marsh Areas
- Extent and Progress of the Soil Data Join Recorrelation Initiative
- Urban Soil Mapping and Classification — Metropolitan-Detroit Soil Survey
- Landscape Stratification and Raster Based Mapping in the White Mountain National Forest
- Soil Microbiology Project with Brooklyn College
- Sandy Lake Plain Ecological Site Descriptions in MLRAs 97 and 98 in Michigan
- Dynamic Soil Properties Project — Hydric Soils in Restored Wetlands in Michigan

These are just a few of the soil survey activities in the glaciated northeast. Soil Survey Region 12 is committed to fostering partnerships and innovative research for soil survey and ecological sites.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Advancing Frontiers in Digital Soil Mapping/Information Applications, Updating & Expanding Soil Survey Operations*

T-65
The Gardena Loam Case Study: Experiential Learning Improves Soil Survey Interpretations
David Hopkins, North Dakota State University; *Keith Anderson,* NRCS, MLRA 56

The Soil Survey of the Tri-County Area, ND published in 1966 by the North Dakota Agricultural Experiment Station anticipated irrigation from the federal Garrison Diversion Project. About 75 percent of the 111,000 ha survey area was later incorporated into the Cass County Soil Survey subset legend for MLRA 56 (Red River Valley of the North). A highly productive soil in the 1966 survey was the Gardena loam. Of 100 soil map units (SMU), only 10 had yields of 38 bu/a; 4 were Gardena consociations or associations. Currently, the Gardena component spring wheat productivity index (PI) is 100 on A slopes and 95 on B slopes. Township tax assessors challenged these PI values at a Tax Assessor workshop in February, 2012. They claimed the soil was too droughty for a Coarse-silty series. Subsequently, ten graduate students in the NDSU's Soils 444/644 course investigated textural family for the 7700 ha of Gardena loam in Cass County. Students developed a GIS database to locate/stratify the Gardena SMUs, created a landowner permission file, conducted a sampling campaign, and performed soil analyses. One hundred locations were sampled (0-25, and 25-100 cm) across the distribution of Gardena in Cass County. The Cass County Director of Equalization bore costs of pipette analysis for the particle size Control Section and a subsample of topsoils. Results show only 9 % of the 100 samples meet Coarse-silty particle size class; seventy percent are Coarse-loamy or Sandy families. Final results and economic implications of the lower PI values will be discussed.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-67
Variability of Seasonal High Water Tables in Minnesota Benchmark Soils
Dan Nath, *John Beck*, and *Mike Walcynzski*, USDA-NRCS

Water table fluctuations in Minnesota have an impact on all major land uses in the state. From agricultural to residential to recreational, the presence and location of free water is important. The seasonal high water table and fluctuations throughout the year are important to characterize benchmark soils throughout the state. Red parent material and the concept of relict features provide challenges to the interpretation of seasonal high water tables in the field. Between 2012 and 2014, nests of piezometers and wells were installed at three sites in Minnesota monitored with pressure transducers linked to dataloggers collecting twice daily data. Two of the sites were installed on the Lester catena in Freeborn and Hennepin Counties, and on the Augustana catena in Lake County. The purpose of this project is to develop a better understanding of water table fluctuations and correlate this to redoximorphic features. To date, the periods of precipitation that are consistent with historical averages are limited but the data have shown unexpected results of the depth to and duration of the water table. The poster will show early results and potential expansion of this project.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-68

Evaluating a Half Century of Dynamic Soil Change for a Benchmark Northern Hapludoll

David Hopkins, Brandon Montgomery, Dean Steele and *Sheldon Tuscherer*, North Dakota State University

North Dakota presents a unique opportunity to study dynamic soil change given its agricultural prominence and extensive soil survey data. A resampling method to characterize change from legacy soil survey data was utilized on the benchmark Barnes soil. Forty Barnes pedons with full profile descriptions and laboratory data taken before 1960 were evaluated. Using mean topsoil thickness (20 cm) and one standard deviation of that mean, the dataset was reduced to 22; a few profiles were removed due to incomplete laboratory data. Final sites were selected based on the Landsat satellite path over eastern ND in order to measure ET as a non-biased proxy of soil health. Four matched pairs were selected; three additional sites were included to measure soil change under native pasture/CRP. This allowed the formal "matched pairs" t test to be used to evaluate significance in physical and chemical properties for the two time periods, historic and current. Soil organic carbon, was statistically lower ($p<0.05$) in topsoils at all seven sites and depending upon management, morphologic change ranged from highly eroded, (complete loss of the A horizon), to non-eroded conditions at sites returned to CRP 25 years ago. The ET results for 6 sites within satellite path clearly show higher values for sites that are only slightly eroded or in CRP. For the three cropped sites, ET values steadily decrease with increasing erosion class, and in three of six sites, from summit to depression landscapes positions, ET values decreased exactly as soil genesis concepts would dictate.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Evolving Vision for Ecological Sites & Soil Health*

T-69

Using LIDAR and the National Cooperative Soil Survey to Assess Red Clay Bank Stability for North Shore Tributaries

John Jereczek, Minnesota Department of Natural Resources

The red clay plain of the western Lake Superior basin extends in a narrow band from northeastern Minnesota to the western portion of Michigan's Upper Peninsula. The predominant soils in this area are red clays interspersed with sands and silts that are geologically young and are undergoing a high rate of natural erosion. They were originally deposited as lake sediment during glacial periods but now, due to lake recession and geologic uplift, they form much of the land mass of present-day Lake Superior's Minnesota and Wisconsin's shore. The Red Clay Project was a research and demonstration project completed in 1980 and sponsored by five soil and water conservation districts from two states with the task of seeking practical solutions to the many forms of red clay erosion. The overall objectives of that project were to demonstrate economically feasible methods of improving water quality, to assess the capabilities of existing institutions to cooperatively implement a pollution control program and to provide data and recommendations that could be used in future programs. Our project builds on the Red Clay Project by utilizing available LIDAR high resolution terrain data and the NRCS Soil Survey data to explicitly map these areas of erosional concern. We used a LIDAR derived DEM to determine slope and aspect overlaid with clay dominated soils to determine potential effects on MN streams flowing to the north shore of Lake Superior. With simple rule sets, these grids were then used to analyze the watersheds' red clay banks and natural erosion hot spots. Once identified, the appropriate land management practices identified in the original report can be applied to these watersheds. Results will be released as a series of GIS layers hosted on the DNR's GDRS. Information derived from this task will be instrumental in developing strategies and actions aimed at achieving and maintaining water quality in a changing landscape and climate.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-71

Development of an Infiltration Index for Land Use Decision Support in Urbanizing Regions

Amanda Liesch, Aziz Amoozegar, *Josh Heitman* and *David Lindbo*, Soil Science Department, North Carolina State University

Conversion of natural areas and agricultural fields to urban development results in a substantial disturbance to the soils and a decrease in infiltration capacity. The general goal of this study was to use readily available soil property data to develop an infiltration index that can assist in identifying potential changes in soil capacity to infiltrate a given storm. The one-dimensional HYDRUS model was used to simulate vertical water flow for assessing infiltration and runoff for 130 different soil profiles composed of two distinct layers with different textures. The simulations were performed for a 5-year storm (54.8 mm/hour rainfall event), and the model inputs for saturated hydraulic conductivity, porosity and bulk density for each case were generated from a database that was assembled from available data in the southeastern U.S. The infiltration/runoff scenarios were then used to calculate an infiltration index, defined as cumulative infiltration divided by rainfall amount. To showcase the impact of development on soil infiltration, a case study was conducted within the area around the NC State University Centennial Campus in Raleigh. Prior to construction of several buildings and a golf course, this area was farmland. The infiltration index for the site was adjusted to reflect

changes in the land surface between 2001 and 2013. Using the elevation data, a modified soil map was constructed, and infiltration capacity was re-calculated. Based on our assessment, due to drastically reduced infiltration capacity of the soils, a five-year storm can result in significant runoff from the developed areas.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-72
Historical Perspectives and Recommendations for Revision of Agricultural Handbook 296
Shawn W. Salley, Jornada Experimental Range, USDA-ARS; *Joel Brown*, New Mexico State University

Major Land Resource Areas (MLRAs) are designed to support the development and coordination of soil and water conservation programs by the NRCS, with the primary document describing MLRA being Agricultural Handbook #296 (1965, 1978, 1981, and 2006). While the most recent edition of the handbook was released in 2006, many of the geographic boundaries consistently mimic historic map products of generalized regional and national soil-survey maps (some dating back to the 1930s). Furthermore, the underlying concepts and technologies used to build MLRA geography predate adoption of present-day ecological approaches to resource management and conservation. Thus a need has arisen to better develop and define the concepts allowing for "unique and defensible" MLRA geography against neighboring MLRAs. For example, an MLRA must be confined within a physiographic province, contain unique ecological sites/soil map units from its adjoining resource areas, and should incorporate advances in soil climate modeling and data-driven digital mapping techniques into MLRA concepts. In preparation for revising the Agricultural Handbook #296, the National Ecological Site Team at the Jornada Experimental Range has begun compiling an extensive geographic database of land use, elevation, topography, climate, water resources, potential natural vegetation, and soils. Our approach to developing data-driven MLRA is to use modern geospatial techniques in order to develop a more robust approach to resource area concepts. Our presentation will demonstrate the historical development of MLRA concepts and provide recommendations for a national framework in which to create more uniform standards and definitions of MLRA relevant to present day resource and conservation needs.

Topic Area: *Enhancing, Promoting & Supporting Soil Data, Evolving Vision for Ecological Sites & Soil Health*

T-73
Sodium Affected Soil and Patterned Ground Relationships in South Central Illinois
Mike Konen and *Jacob Kruse*, Northern Illinois University; *Sam Indorante,* NRCS

High pH, sodium affected soils (SAS) occupy approximately 383,512 ha in south central Illinois. SAS occurs on extremely low-relief, planar landscapes where 1-2 m of Wisconsin Episode loess overlies a leached, lower permeability Sangamon Geosol. Previous research suggests that differential water movement and variations in evapotranspiration were the mechanisms responsible for sodium redistribution. Recent updating and digitization of Illinois soil surveys has revealed the occurrence of large areas of polygonal patterned ground associated with SAS. Not all SAS is associated with polygonal patterned ground. The polygonal patterned ground is interpreted to have formed as a result of Wisconsin Episode permafrost formation and degradation. Most polygons are 10 to 80 m in diameter with 4 to 6 m borders. Polygon location strongly impacts pedologic properties.. SAS are associated with the polygon borders. While there are multiple pathways responsible for the formation of SAS, we will focus our discussion on the geomorphic significance of permafrost related processes and how they have led to a unique microtopography that has in turn led to the formation of SAS in south central Illinois.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-76
Eighth International Acid Sulfate Soils Conference
Martin Rabenhorst and Delvin Fanning, University of Maryland, Department of Environmental Science & Technology*; Maxine Levin* and *Thomas Reinsch* USDA-NRCS*; W. Lee Daniels,* Virginia Tech University

Previous International Acid Sulfate Soils Symposia/Conferences took place in Wageningen (Netherlands) 1972; Bangkok, Thailand 1981; West Africa – Dakar, Senegal and Guiné Bissau 1986; Ho Chi Minh City, Vietnam 1992; Tweed Heads, Australia 2002; Guangzhou, China 2008, and Vaasa, Finland 2012. None have been held in the U.S., but a two day field tour supported by the international acid sulfate soils working group and SSSA, which traversed primarily Coastal Plain sites in Delaware, Maryland and Virginia, took place for World Congress of Soil Science in Philadelphia in 2006. Papers from the first four symposia appeared as publications of the International Land Reclamation Institute, Wageningen. Those of the 5th Conference were published in a special double-issue of the Australian Journal of Soil Research, whereas those of the 6th were by Guangzhou Science & Technology Press

and those of the 7th by the Geological Survey of Finland. The term acid sulfate soils came into use for the first symposium by Leen Pons (deceased 2008, called in a book honoring him, the Father of the International Acid Sulfate Soils Symposia/ Conferences) and other organizers. In an initial paper, Pons proposed that the term "Acid Sulphate Soils be used in the widest sense of the expression. As such this expression pertains to all materials and soils in which as a result of processes of soil formation, sulfuric acids either will be produced, are being produced or have been produced in amounts that have a lasting effect on main soil characteristics". This broad definition includes potential, active, and post-active acid sulfate soils and soil materials, of which by current tentative plans, examples of all three forms will be shown on field trips for the 8th Conference. Three field trips are tentatively planned for the 8th Conference: 1) a pre-conference tour on Sunday, July 17; a mid-conference tour on Wednesday, July 20; and a post-conference tour Friday (and possibly Saturday), July 22 (-23). In a paper at the 1st Conference, David Rickard described iron sulfides accumulation in estuarine soils and sediments from sulfate in sea water and iron from iron oxides as organic matter is oxidized by S-reducing bacteria by an overall process we now call sulfidization. Rickard, at Cardiff University, Wales, UK, in 2012 published (Elsevier) a book, Sulfidic Sediments and Sedimentary Rocks that documents that many sediments and sedimentary rocks throughout geologic columns contain pyrite accumulated by such processes. In another paper at the 1st Conference, Nico van Bremen, who completed his doctoral dissertation at Wageningen on acid sulfate soils in Thailand, described processes that take place when sulfidic materials (that he subsequently helped to re-define for Soil Taxonomy) are exposed to aerobic conditions to undergo what we now call sulfuricization, to form sulfuric horizons. At the 8th Conference we hope to honor these and other early acid sulfate soils workers. Previous conferences have emphasized what some call Coastal Acid Sulfate Soils. During the 8th Conference we hope to show that acid sulfate soils principles apply to many soils in the U.S. and that engineers and others involved in land disturbance activities and issues need to pay attention.

Topic Area: *Enhancing, Promoting & Supporting Soil Data*

T-77
TSS Requests and Database Projects Driving Field Projects
Rachel Stout Evans, USDA-NRCS

This type of Technical Soil Service activity is not a typical request (usually two of these a year). When the area forester or state forester calls for assistance, I do what I can to help. Drafting an order 3 initial soil survey map for a WRP tract inside the levee helps them match soil type to tree species and close on a tract, positively impacting the Mississippi River Basin Healthy Watershed Initiative, and it keeps up my mapping skills. Moreover, it highlights the need of a future MLRA project to completely remap the alluvial lands inside the levee in one continuous map north to south from Tunica to Issaquena County. This type of TSS also works hand in hand with my SDJR projects by allowing me to collect notes and data while joining all four alluvial map units together and put in place holders of known soil components based on previous mapping experience and data in Tunica County (updated map, 2006).

Topic Area: *Updating & Expanding Soil Survey Operations*

T-78
Spatial Predictions of Biological Soil Crust Class: A Value Added Soil Survey Product
Colby Brungard, Utah State University

Biological soil crusts (BSC) are key components of arid and semi-arid ecosystems, but are susceptible to surface disturbance from land use practices. Potential BSC (BSC in the absence of major soil surface disturbance) could be inferred from undisturbed areas. Canyonlands National Park is one of the best available areas on the Colorado Plateau to assess potential BSC development. Biological soil crust observations from Canyonlands National Park were obtained from a recent soil survey update. Observations consisted of seven level-of-development (LOD) classes representing a BSC development sequence. The seven LOD classes were combined into three broad LOD classes: low, moderate and high. Abiotic environmental covariates representative of soil properties and microclimate effects influencing BSC distribution were derived from Landsat 7 ETM+ imagery and a 30 m digital elevation model. Stochastic gradient boosting, random forests and logistic regression models were compared for LOD class prediction. Potential BSC class distribution was predicted over approximately 8300 km2 surrounding Canyonlands National Park. Moderate BSC LOD class distribution was predicted with reasonable accuracy. Predicted spatial patterns of the low and high LOD classes appear plausible. Spatial predictions of LOD classes may be useful for assessing the impact of past land uses on biological soil crusts. Spatially explicit covariates related to soil/geological type and slope are the most important covariates for predicting potential BSC LOD classes.

Topic Area: *Updating & Expanding Soil Survey Operations*

T-80

The Distribution and Genesis of Eroded Phase Soils in the Continental United States

Nicolas Jelinski, University of Minnesota

The delineation and mapping of eroded phases of existing soil series has been an important activity throughout the history of the U.S. soil survey, with implications for land management, crop production and the estimation of historical sediment losses and fluxes. Mapping eroded phase soils presents a subjective problem requiring two levels of abstraction from field morphologies, and thus presents an interesting study in the consistency of mapping efforts by political boundaries and physiographic regions. I analyzed the SSURGO database and show that 462,979 km2 of eroded phase soils have been mapped in the continental United States, with 9% of 2013 cultivated lands occurring on eroded soils. Eroded phases of 9 soil orders (excluding Gelisols, Oxisols and Histosols) have been mapped in the continental U.S. Examining the distribution of eroded phase soils within physiographic (ecoregion) boundaries reveals consistent patterns in land-use histories and eroded soils.

Topic Area: *Updating & Expanding Soil Survey Operations*